US008307734B2

(12) United States Patent
Shimizu et al.

(10) Patent No.: US 8,307,734 B2
(45) Date of Patent: *Nov. 13, 2012

(54) **CABLE CONNECTION STRUCTURE**

(75) Inventors: **Toshihiro Shimizu**, Chiryu (JP); **Atsuki Sasaki**, Nagoya (JP); **Seiya Nishimura**, Okazaki (JP)

(73) Assignee: **Toyota Boshoku Kabushiki Kaisha**, Aichi-ken (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 861 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/438,870**

(22) PCT Filed: **Jun. 29, 2007**

(86) PCT No.: **PCT/JP2007/063112**

§ 371 (c)(1), (2), (4) Date: **May 6, 2009**

(87) PCT Pub. No.: **WO2008/026371**

PCT Pub. Date: **Mar. 6, 2008**

(65) **Prior Publication Data**

US 2009/0317176 A1 Dec. 24, 2009

(30) **Foreign Application Priority Data**

Aug. 31, 2006 (JP) 2006-235349

(51) **Int. Cl.**
B60N 2/42 (2006.01)

(52) **U.S. Cl.** **74/502.4**; 74/500.5; 297/216.12

(58) **Field of Classification Search** .... 74/488, 74/489, 500.5, 501.5 R, 502.4, 502.6; 297/216.12; *B60N 2/42*

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,637,655	A	1/1987	Fourrey et al.	
7,484,798	B2 *	2/2009	Yamaguchi	297/216.12
8,042,428	B2 *	10/2011	Shimizu et al.	74/502.4
2003/0160481	A1 *	8/2003	Veine et al.	297/216.12
2008/0246323	A1	10/2008	Kuno	
2008/0252128	A1	10/2008	Nishikawa et al.	

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 174 884 A1 3/1986

(Continued)

OTHER PUBLICATIONS

English language Abstract of JP 2001-208036 A, Aug. 3, 2001.

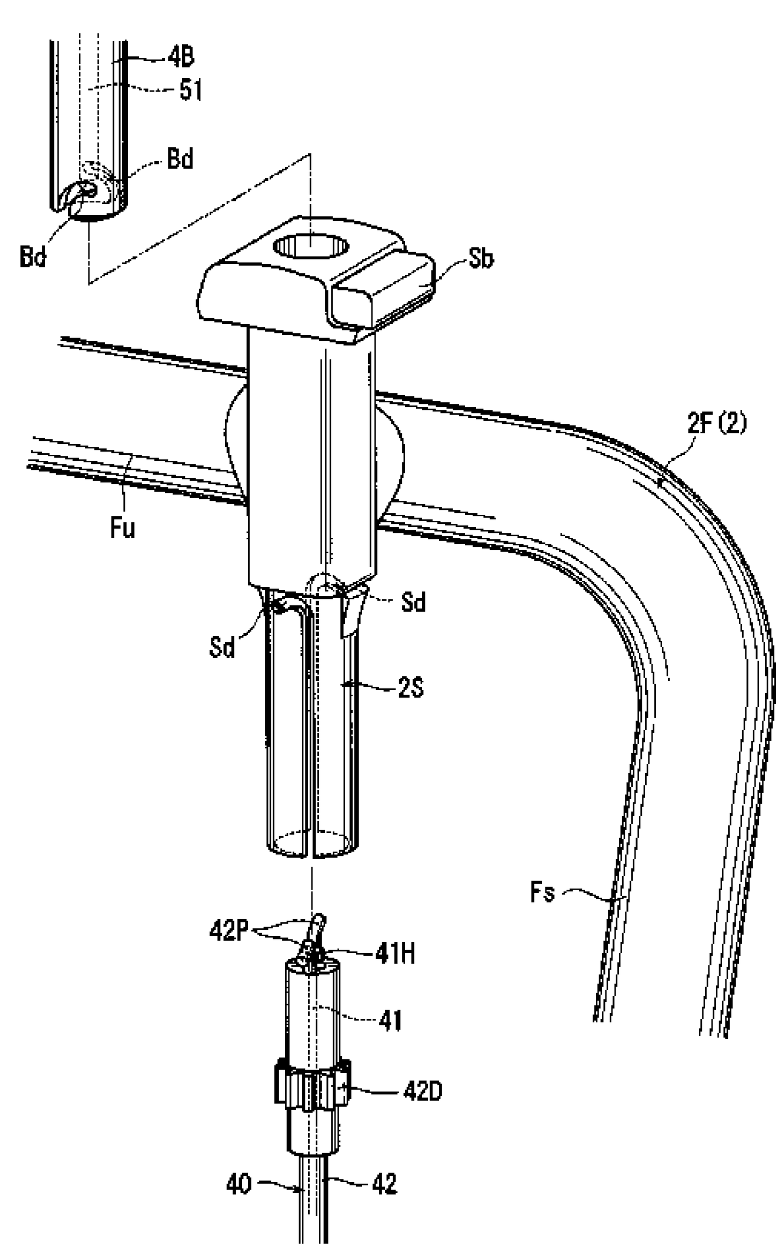
(Continued)

Primary Examiner — Richard W Ridley
Assistant Examiner — Thomas Diaz
(74) *Attorney, Agent, or Firm* — Greenblum & Bernstein, P.L.C.

(57) **ABSTRACT**

A connection end portion of a inner member is provided with engagement projections and a connection end portion of a stay is formed with reception grooves that are capable of axially receiving the engagement projections. When operation cable is axially inserted into a cylindrical support, the engagement projections are axially received in insertion grooves and are retained in terminal end positions thereof that are bent in a circumferential direction. When the stay is axially inserted into the cylindrical support in this condition, the engagement projections are axially received in the reception grooves and move to terminal end positions thereof that are bent in an opposite circumferential direction. As a result, the operation cable is positioned in an axial connection condition in which the operation cable is suspended in the stay.

5 Claims, 15 Drawing Sheets



U.S. PATENT DOCUMENTS

2009/0102266	A1	4/2009	Furukawa et al.
2009/0126520	A1	5/2009	Yamaguchi et al.

FOREIGN PATENT DOCUMENTS

EP	1407151		11/2004
FR	2568528	A1	2/1986
FR	2777325		10/1999
JP	61-92620	A	5/1986
JP	5-32820	U	4/1993
JP	2001-208036	A	8/2001
JP	2003-299549	A	10/2003
JP	2005-087650	A	4/2005
JP	2005-104259	A	4/2005
JP	2005-212596	A	8/2005
WO	97/29290		8/1997

OTHER PUBLICATIONS

English language Abstract of JP 2005-087650 A, Apr. 7, 2005.
English language Abstract of JP 2005-212596 A, Aug. 8, 2005.
English language Abstract of JP 2003-299549 A, Oct. 21, 2003.
English language machine translation of JP 5-32820 U, Apr. 30, 1993.
English language Abstract of JP 2005-104259 A, Apr. 4, 2005.
U.S. Appl. No. 12/210,529, to Furukawa et al., which was filed Sep. 15, 2008.
U.S. Appl. No. 12/259,612, to Suzuki et al., which was filed Oct. 28, 2008.
U.S. Appl. No. 12/356,866, to ABE, which was filed Jan. 21, 2009.
U.S. Appl. No. 12/438,784, to Nishiura et al., which was filed Feb. 25, 2009.
U.S. Appl. No. 12/438,861, to Shimizu et al., which was filed Feb. 25, 2009.
U.S. Appl. No. 12/415,025, to Matsui, which was filed Mar. 31, 2009.
U.S. Appl. No. 12/426,540, to Otsuka, which was filed Apr. 20, 2009.
English language Abstract of JP 2005-212596 A, Aug. 11, 2005.
English language Abstract of JP 2005-104259 A, Apr. 21, 2005.

* cited by examiner

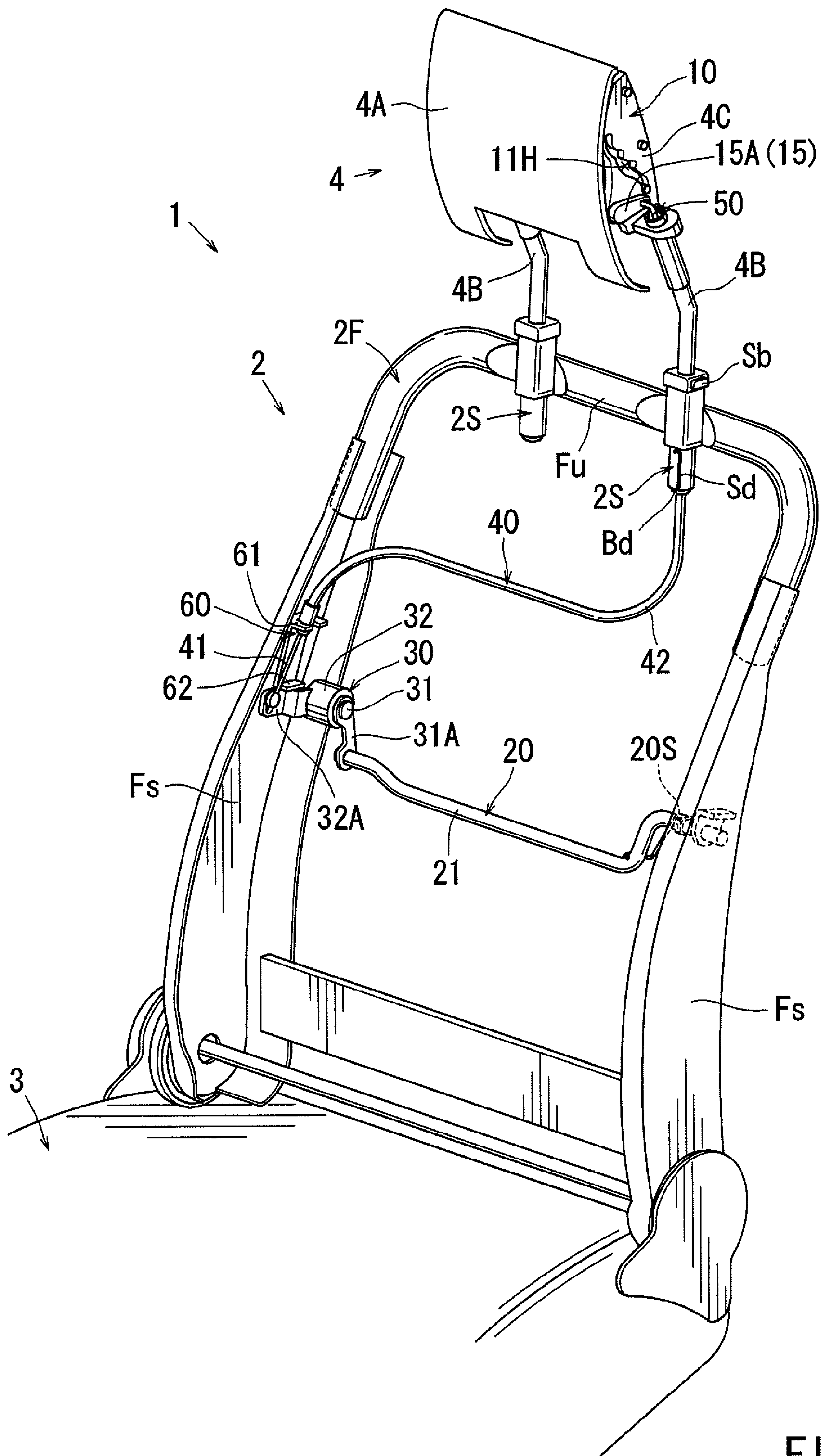

10
4A
4C
11H
15A (15)
4
50
1
4B
4B
2F
2
Sb
2S
Fu
2S
Sd
Bd
40
61
60
32
41
30
42
62
31
31A
20
20S
Fs
32A
21
Fs
3

FIG. 1

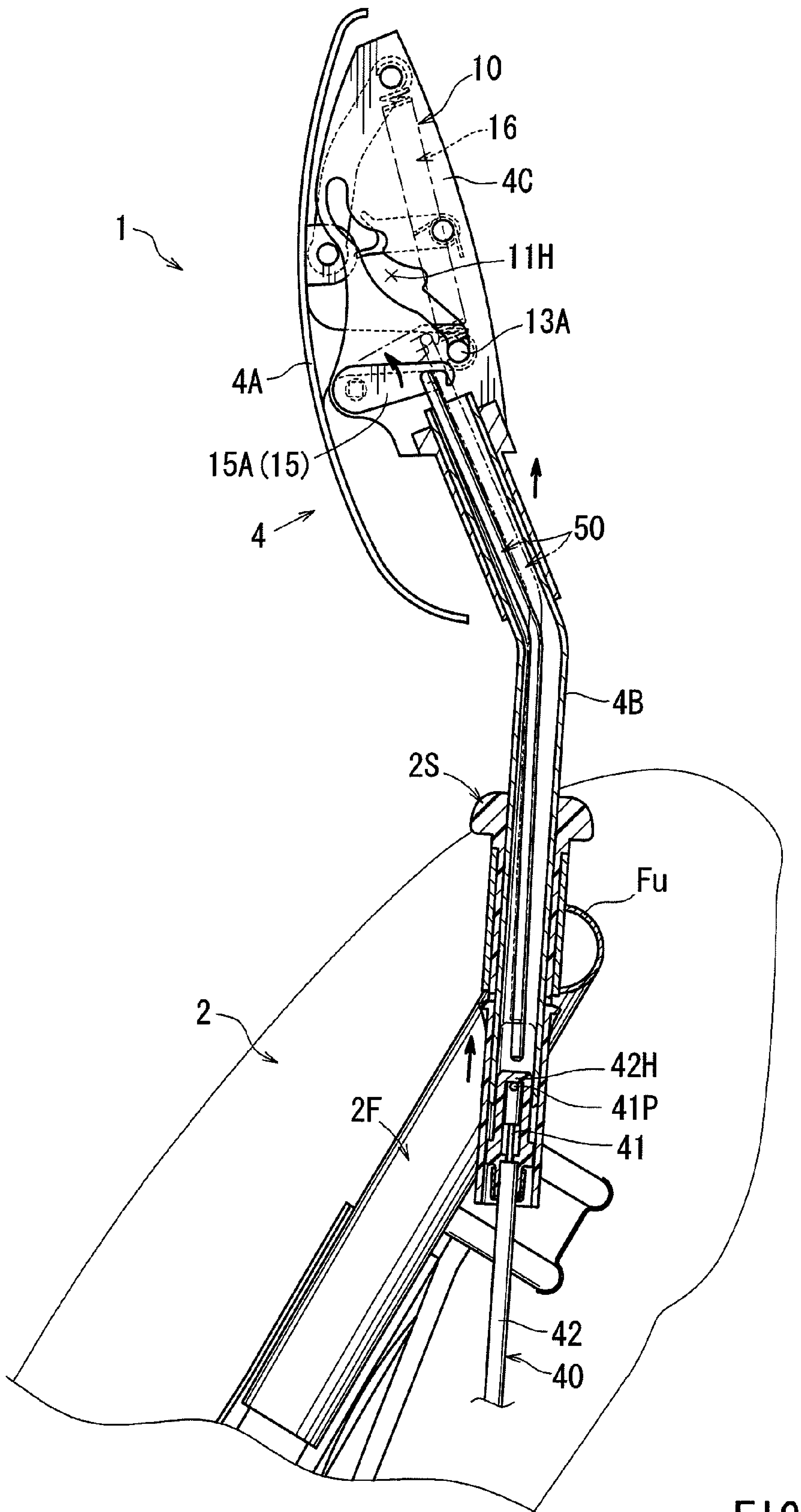


FIG. 2

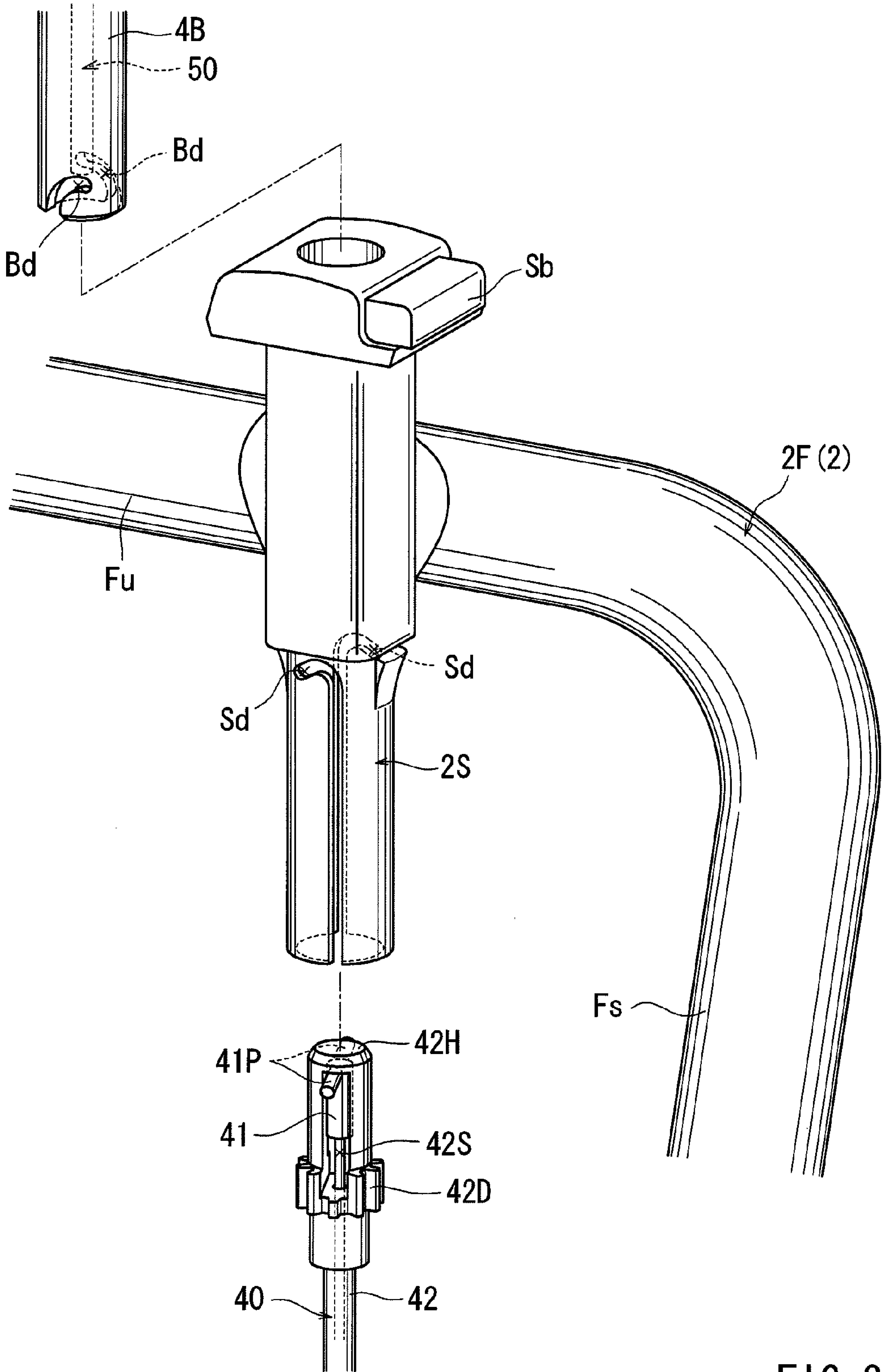


FIG. 3

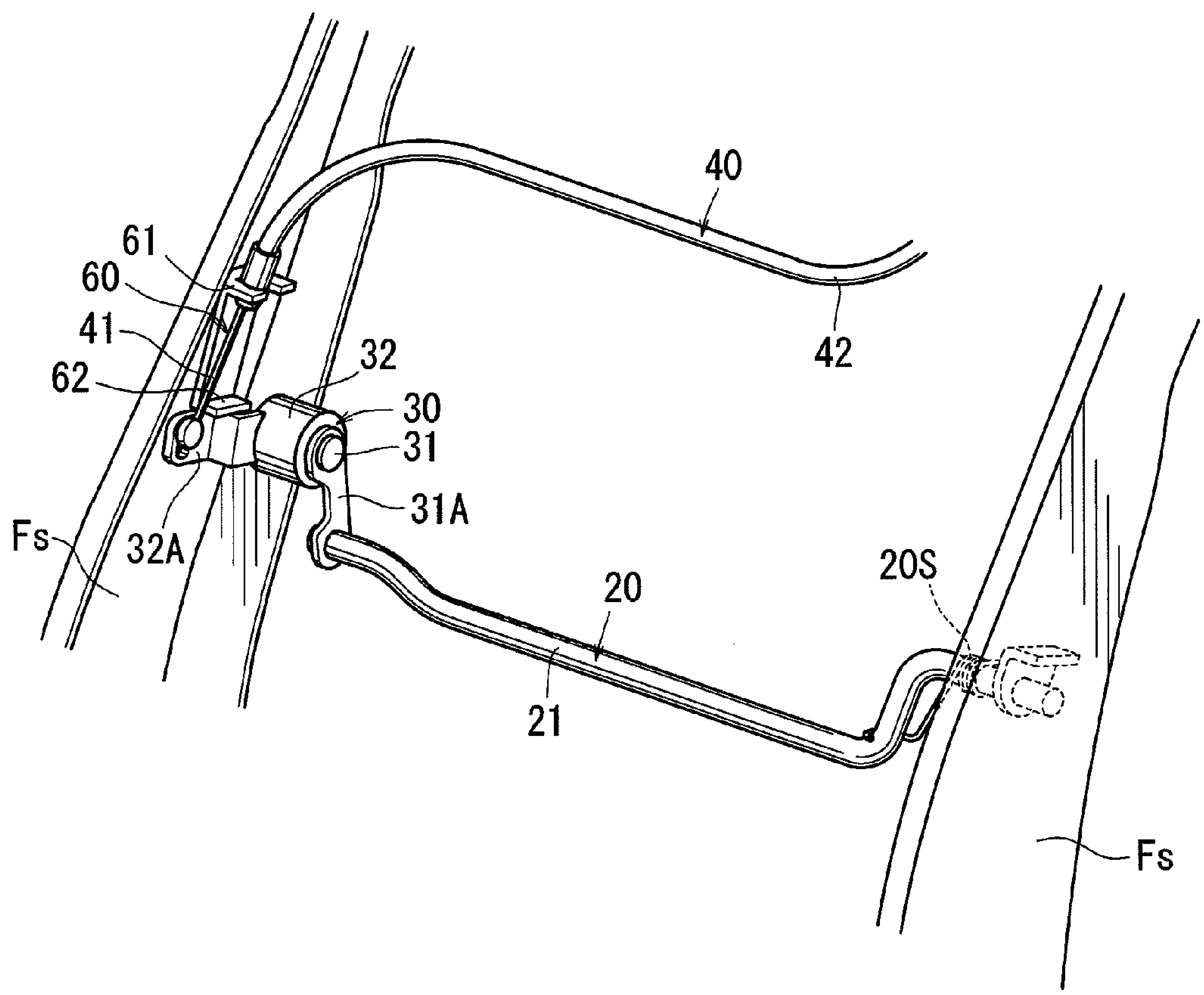


FIG. 4

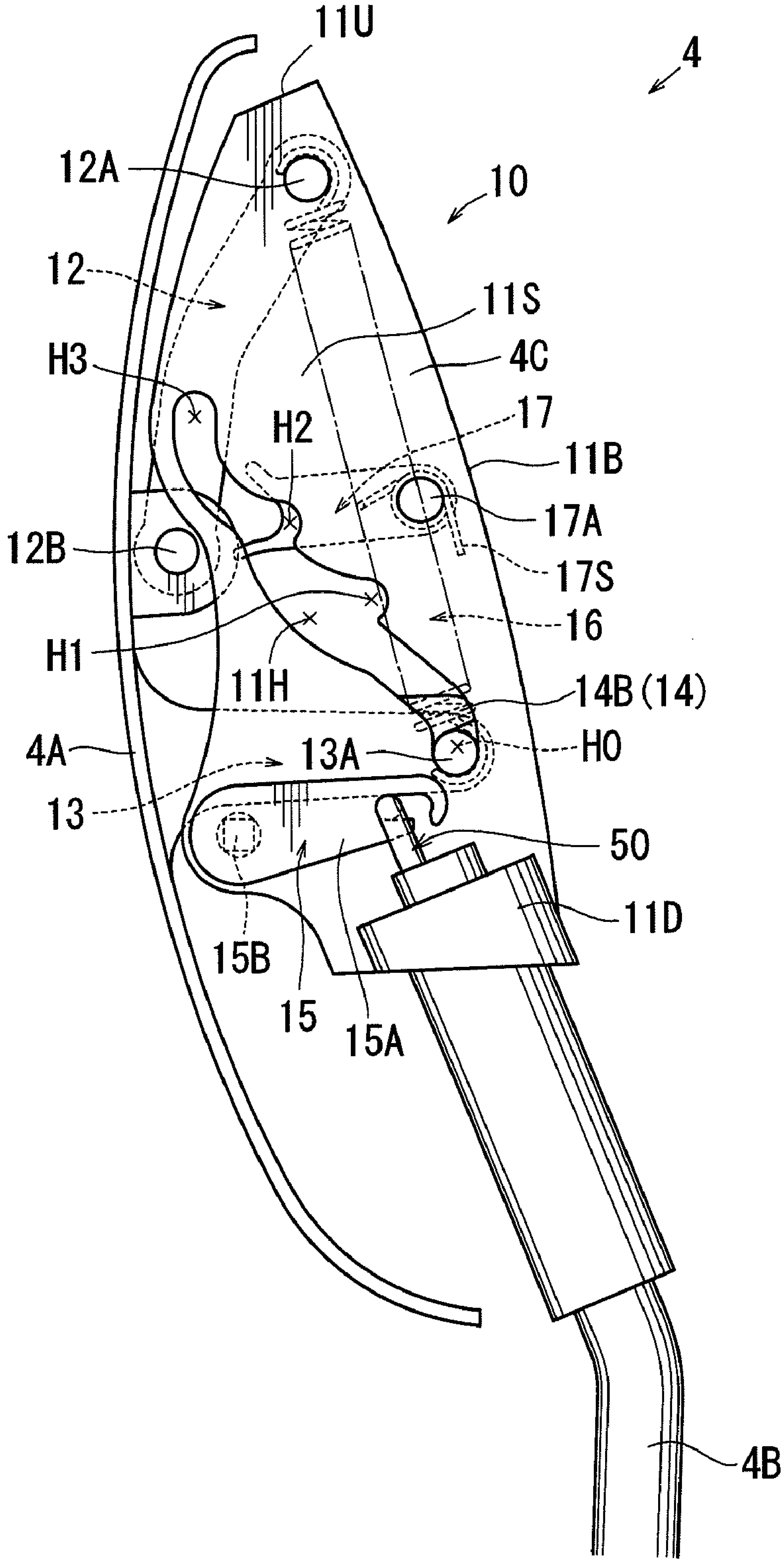

11U
4
12A
10
12
11S
4C
H3
17
H2
11B
17A
12B
17S
16
H1
11H
14B(14)
4A
13A
H0
13
50
11D
15B
15
15A
4B

FIG. 5

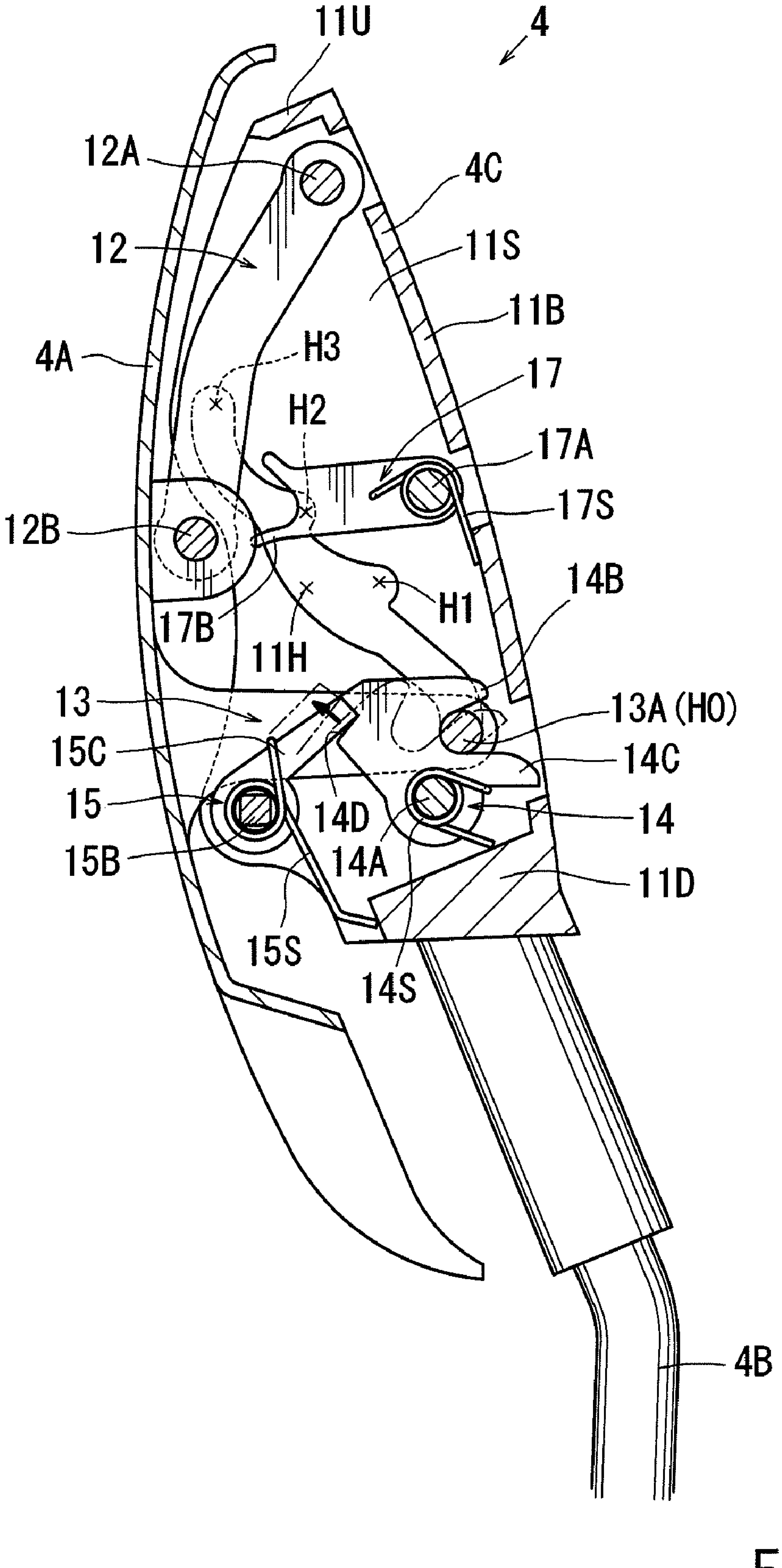

11U
4
12A
4C
12
11S
11B
4A
H3
17
H2
17A
17S
12B
14B
H1
17B
11H
13
13A (H0)
15C
14C
15
14D
14
15B
14A
11D
15S
14S
4B

FIG. 6

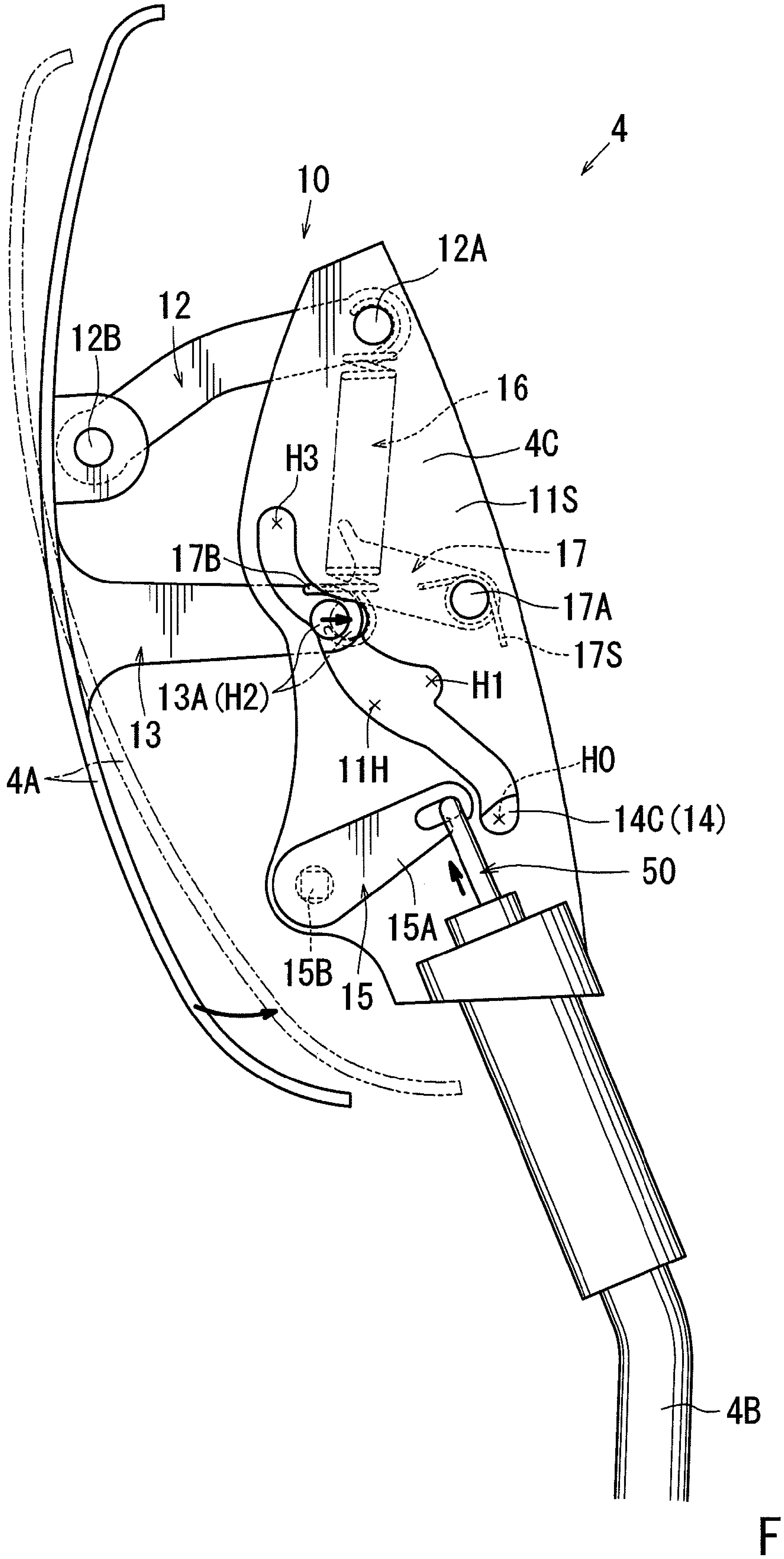

4
10
12A
12
12B
16
4C
H3
11S
17B
17
17A
17S
13A (H2)
H1
13
4A
11H
H0
14C (14)
50
15A
15B
15
4B

FIG. 7

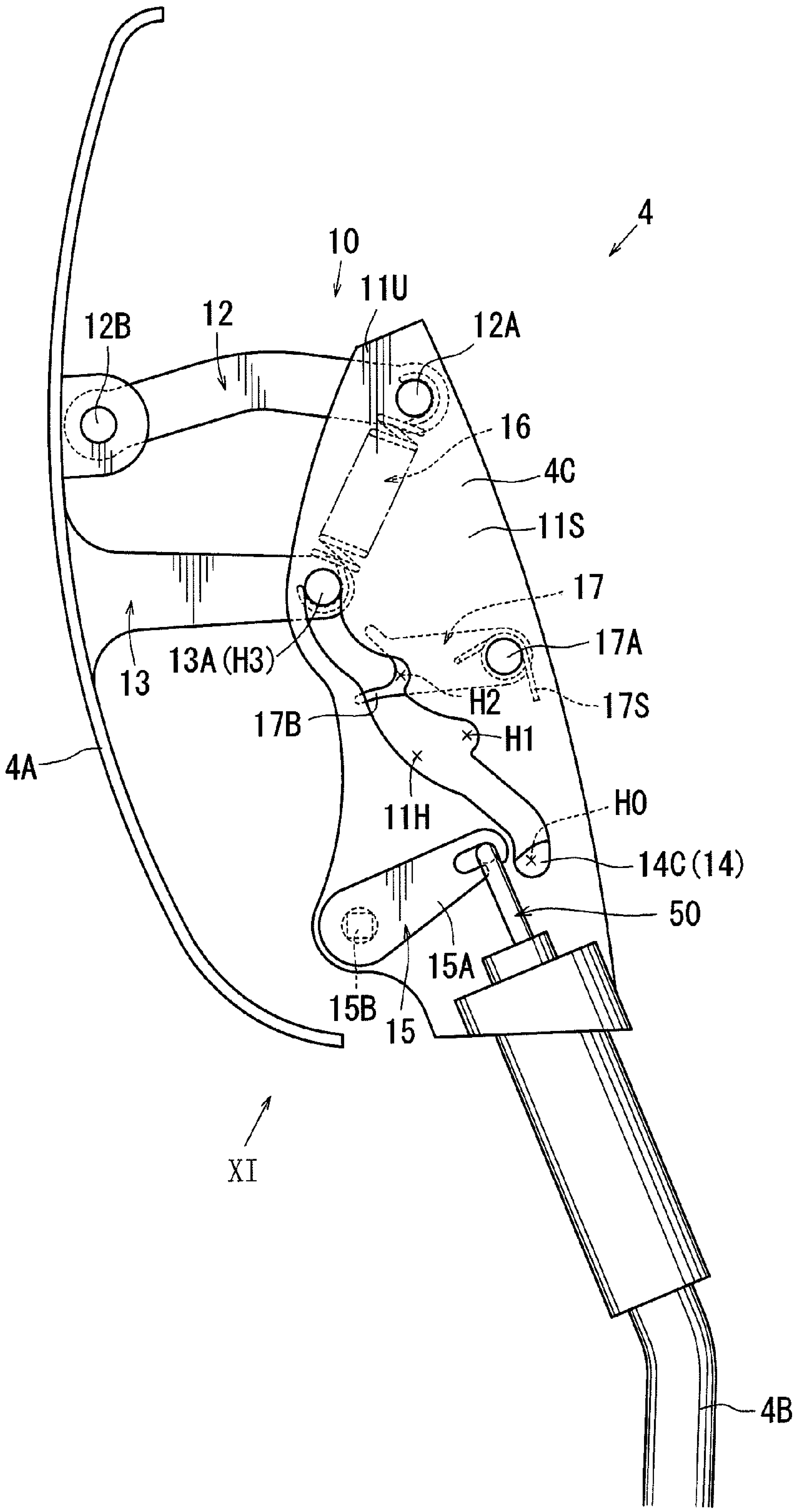

4
10
11U
12B
12
12A
16
4C
11S
17
17A
13A (H3)
13
H2
17S
17B
H1
4A
11H
H0
14C (14)
50
15A
15B
15
XI
4B

FIG. 8

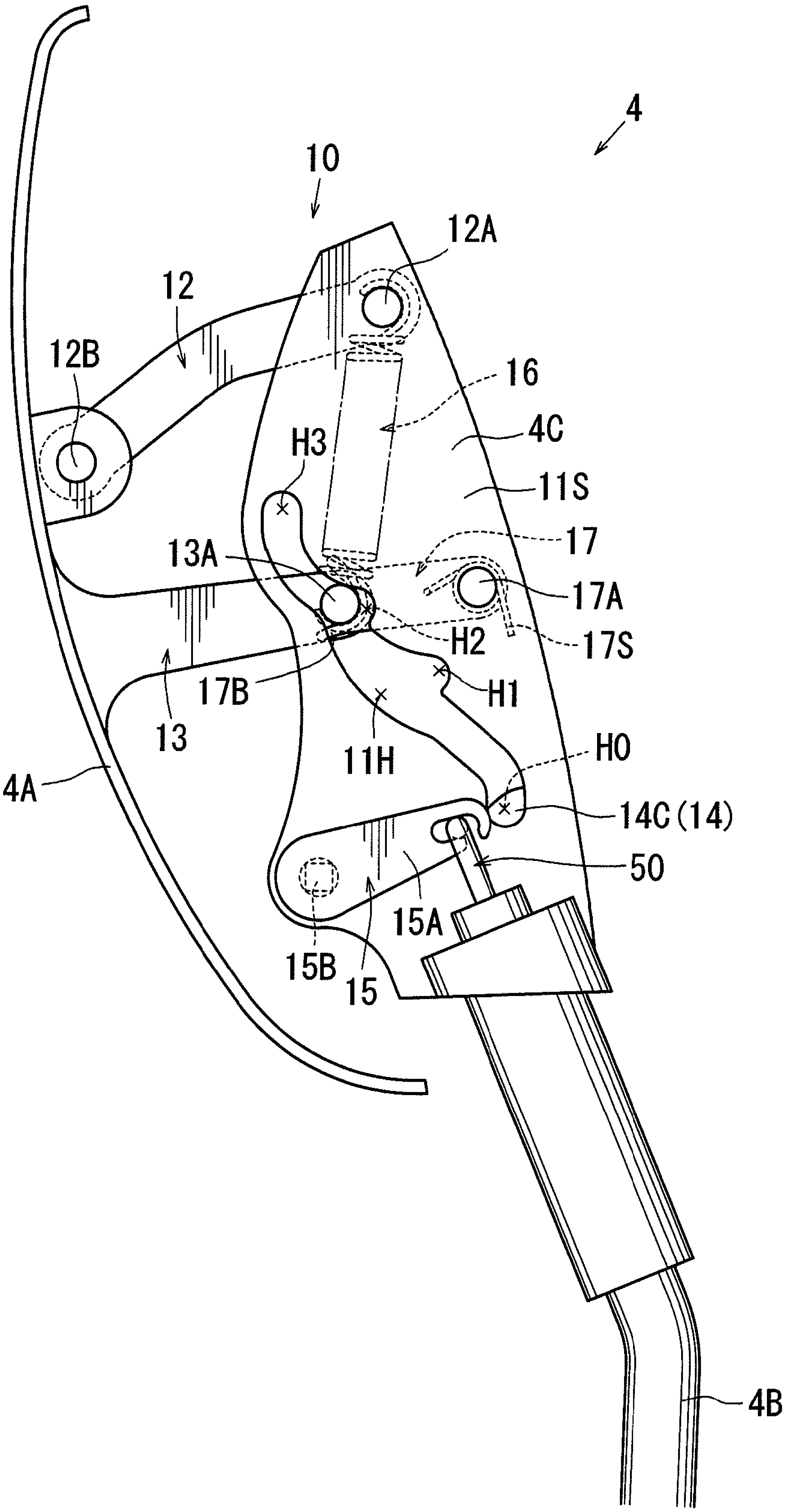

4
10
12A
12
12B
16
4C
H3
11S
17
13A
17A
H2
17S
17B
H1
13
11H
H0
4A
14C(14)
50
15A
15B
15
4B

FIG. 9

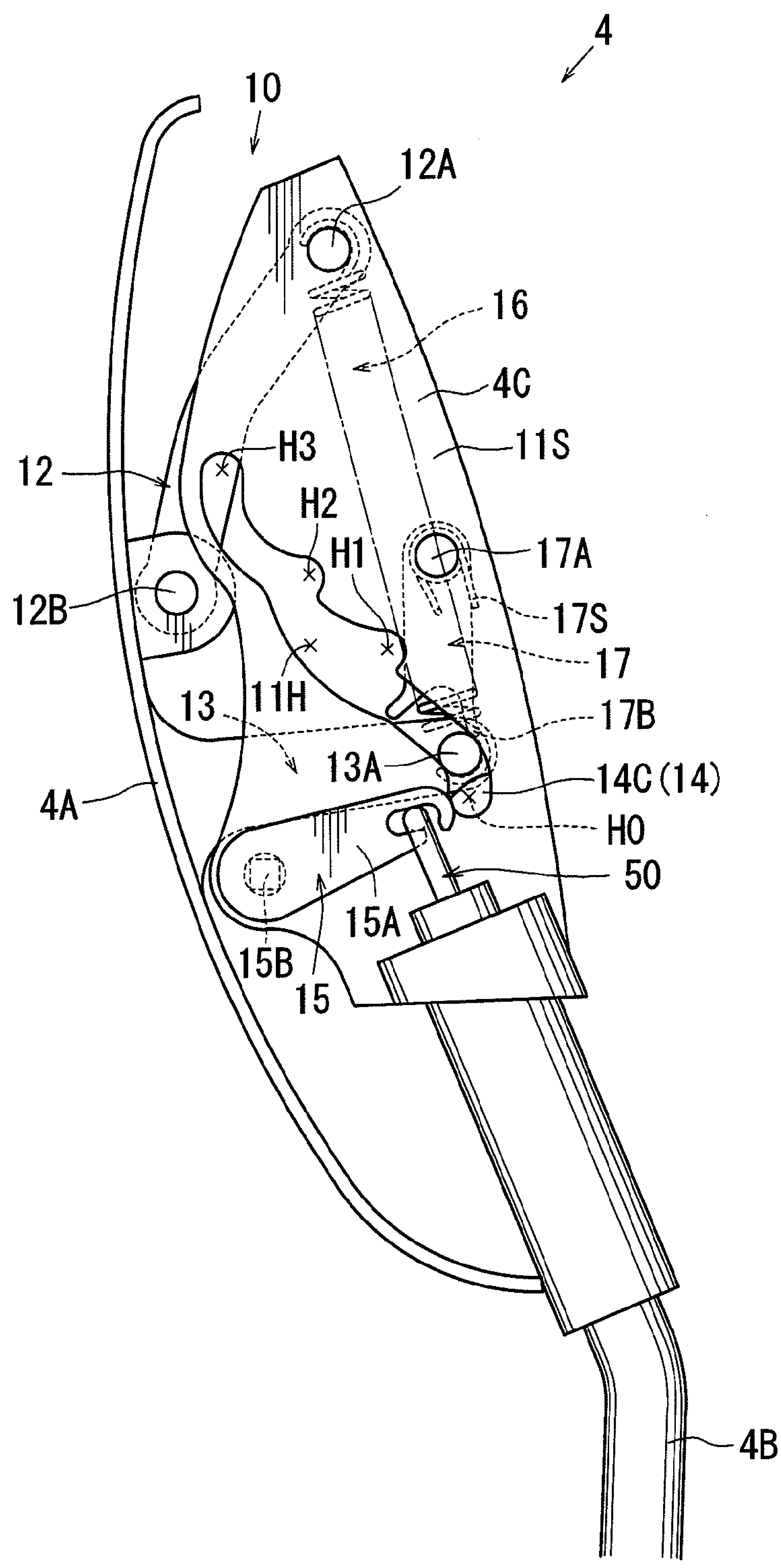

4
10
12A
16
4C
11S
12
H3
H2
H1
17A
12B
17S
17
13
11H
17B
13A
14C(14)
4A
H0
50
15A
15B
15
4B

FIG. 10

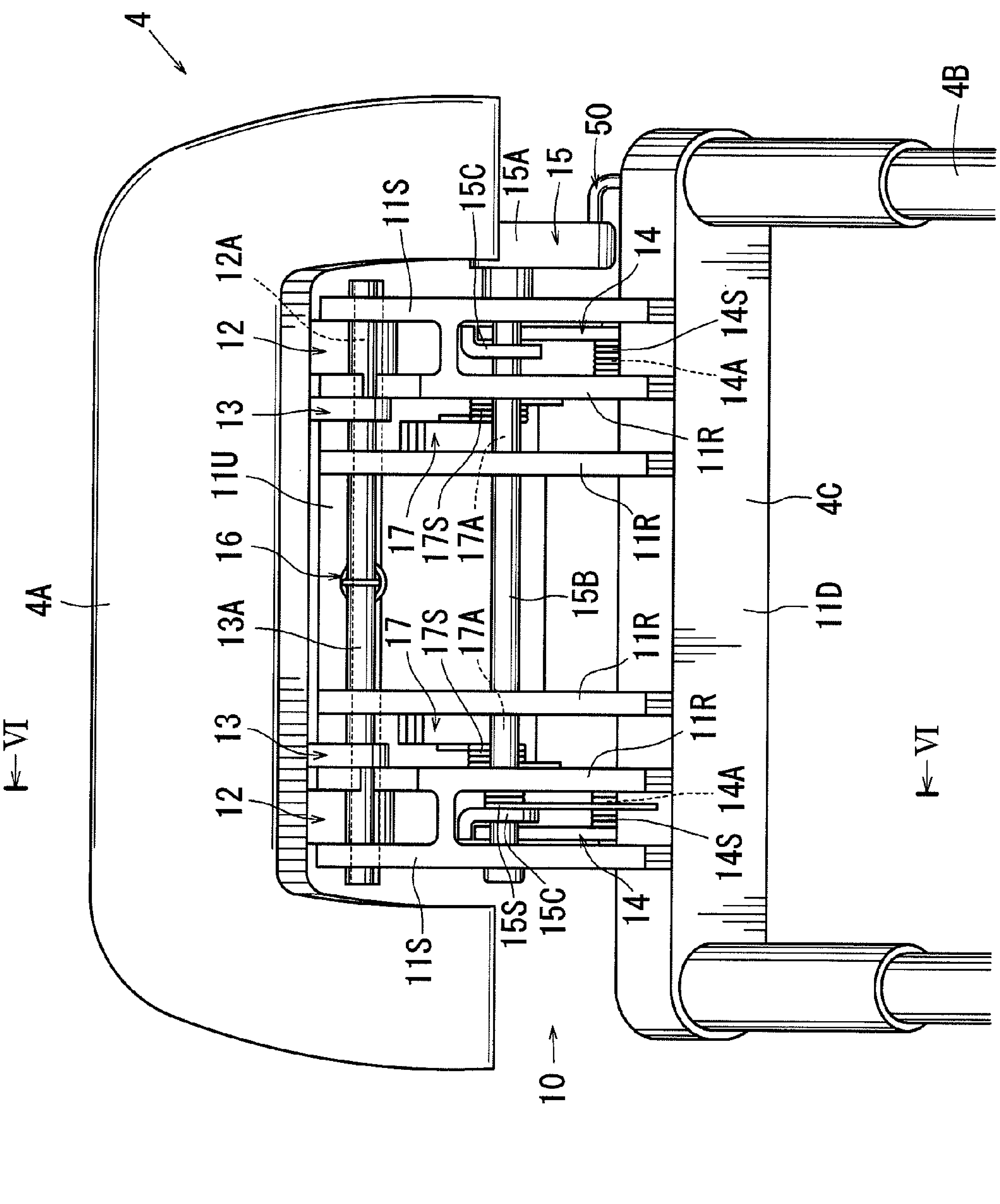

4
4A
4B
4C
10
11D
11R
11S
11U
12
12A
13
13A
14
14A
14S
15
15A
15B
15C
15S
16
17
17A
17S
50
VI

FIG. 11

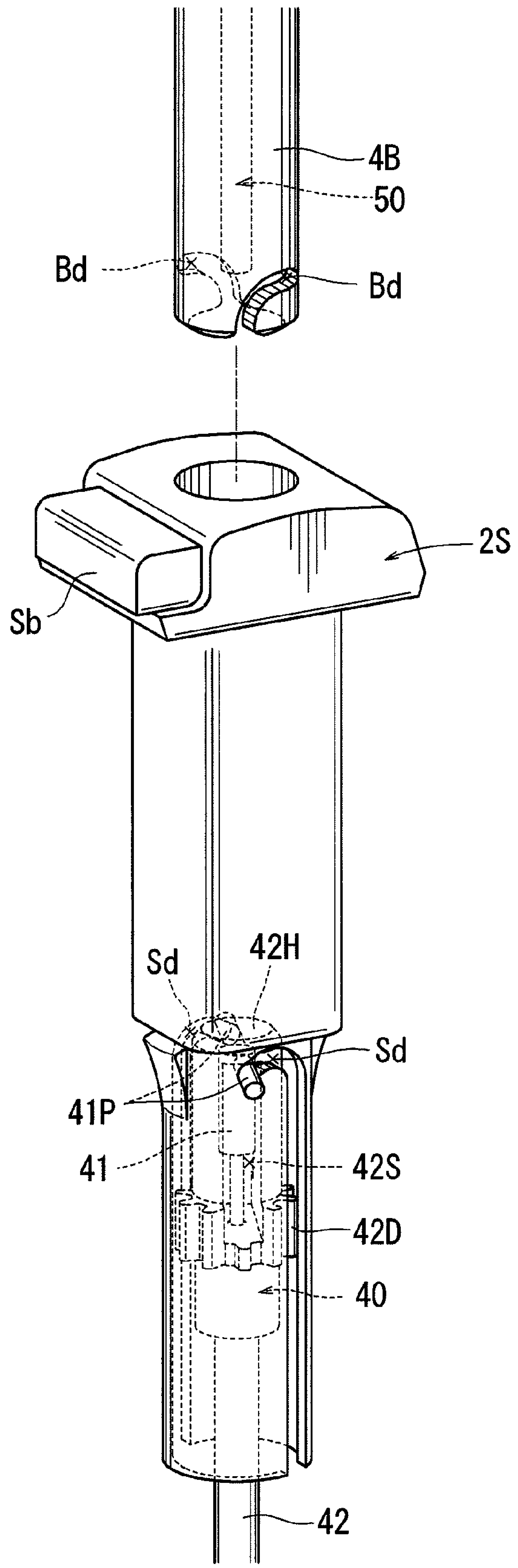


FIG. 12

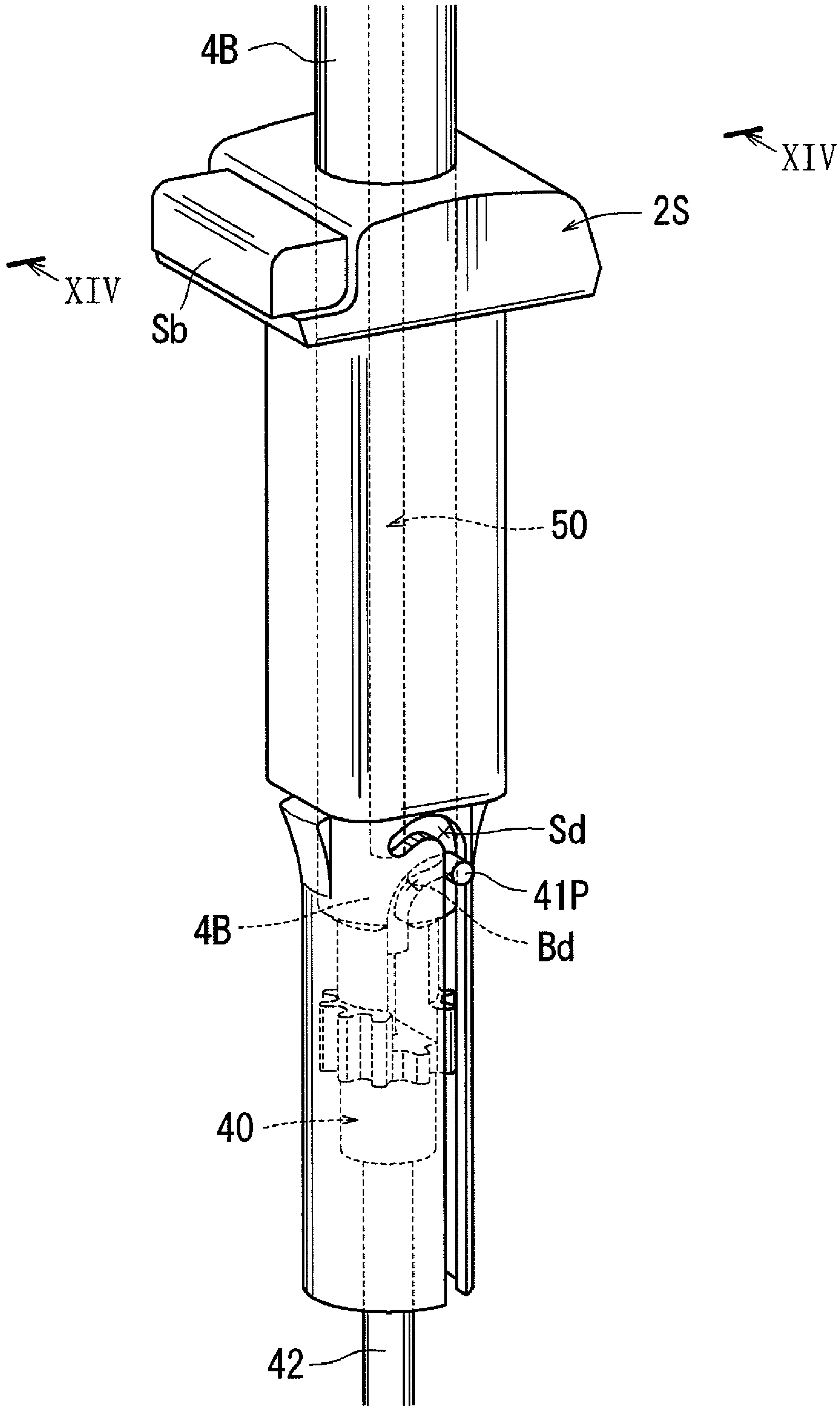


FIG. 13

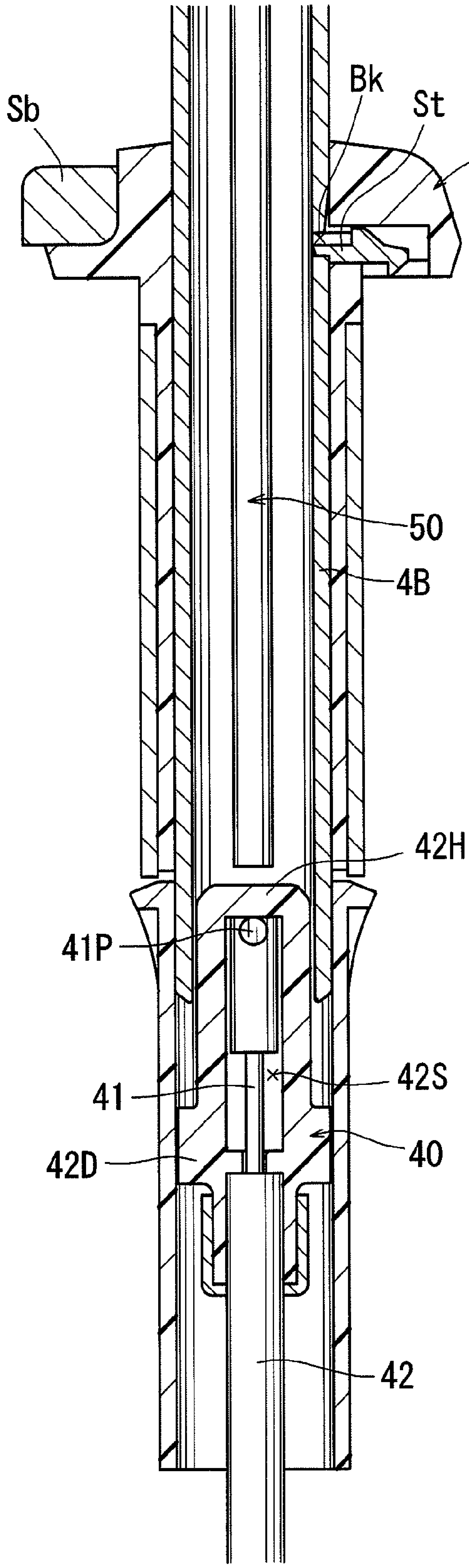


FIG. 14

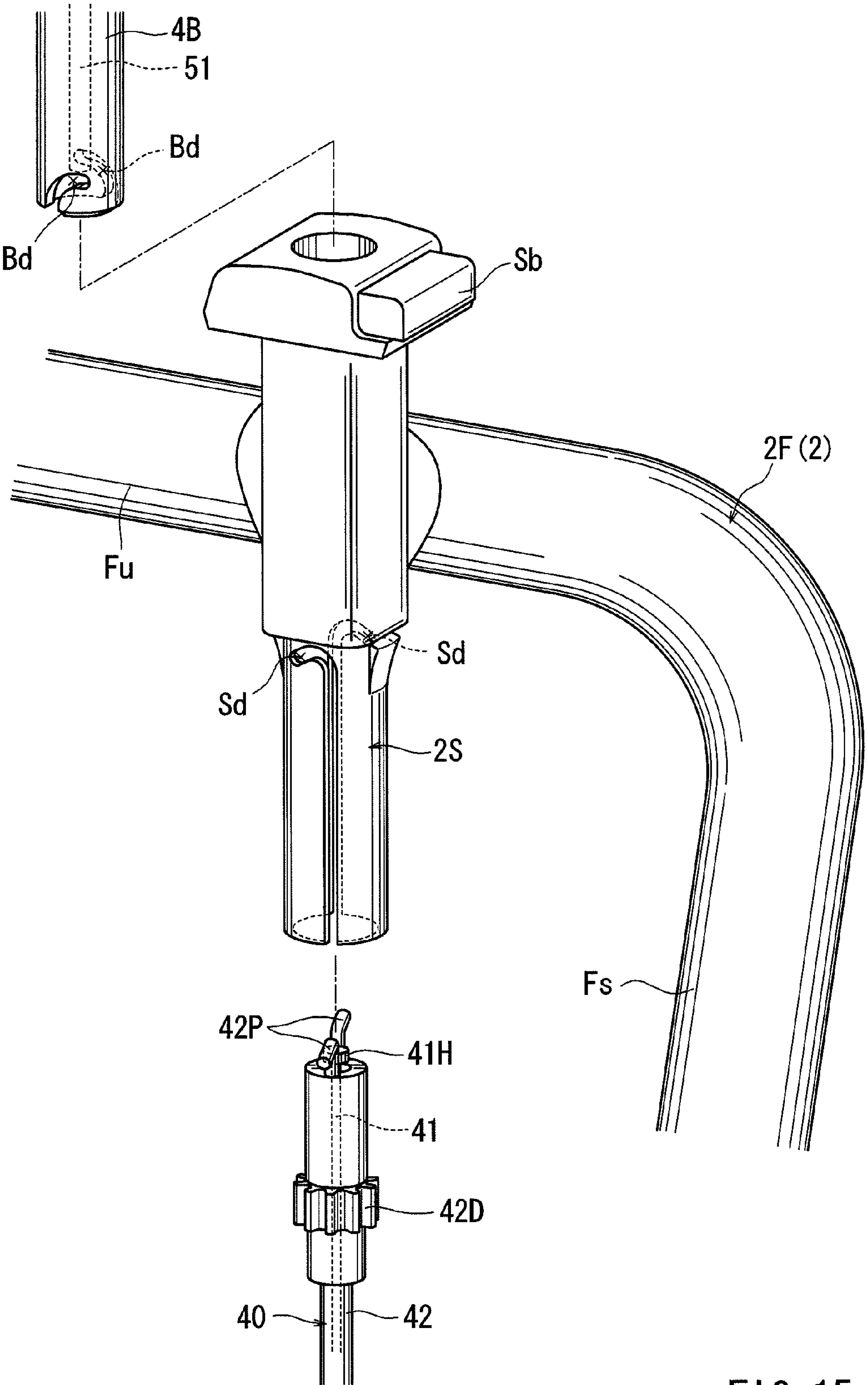


FIG. 15

CABLE CONNECTION STRUCTURE

TECHNICAL FIELD

The present invention relates to a cable connection structure. More particularly, the present invention relates to a cable connection structure in which two cables are axially connected to each other.

BACKGROUND ART

Conventionally, there is a vehicle seat having a mechanism that is capable of instantaneously moving a headrest forwardly so as to support a head of a sitting person when a vehicle back-side collision happens. An operation mechanism for moving the headrest forwardly as described above is known. The operation mechanism uses an operation cable that is pulled by a seat back loading that is applied to a seat back by the sitting person when the vehicle back-side collision happens.

This operation cable is disposed so as to extend from inside of the headrest to inside of the seat back through a stay that may function as a support pillar thereof. Therefore, in a case that the headrest is constructed to be detachable with respect to the seat back, it is necessary to take various structural measures in order to dispose the operation cable. For example, the operation cable can be divided to two portions. The divided portions are respectively previously disposed in the headrest and the seat back, so that end portions thereof are connected to each other when the headrest is attached to the seat back.

Japanese Laid-Open Patent Publication No. 2003-299549 teaches a technique in which electrical cables separately disposed within a headrest and a seat back can be connected to each other during headrest attaching operation. According to this technique, one of the electrical cables is inserted into a tubular stay of the headrest. A connection terminal of the cable is retained at a lower end of the stay. Conversely, the other of the electrical cables is also inserted into a cylindrical stay-insertion support that is disposed in an upper portion of the seat back. A connection terminal of the cable is retained within the cylindrical support while maintained in a standby condition for connection. Thus, the connection terminals of both of the electrical cables can be axially integrally connected to each other when the stay is inserted into the cylindrical support. When the stay is operated in an insertion direction while the electrical cables are connected, an operational force is produced so that a condition in which the connection terminal is retained can be canceled by the force. Thus, in a condition that the electrical cables are connected, the stay can be inserted into a desired position in which the stay is stopped.

DISCLOSURE OF THE INVENTION

Problem to be Solved by the Invention

However, in the conventional technique taught by the above-mentioned patent document 1, connection end portions of the electrical cables are axially overlapped as the stay is inserted, thereby forming a connecting structure in which the connection end portions elastically engage with each other via clawed mechanisms thereof. Therefore, a connecting condition of the cables can be released by inserting the stay into the support or pulling the stay from the support.

The present invention has been made in order to solve the above-mentioned problem. It is an object of the present invention to securely connect connection end portion of two cables by axially overlapping the connection end portions so as to be prevented from being disengaged.

Means for Solving the Problem

In order to solve the above-mentioned problem, a cable connection structure of the present invention uses a following means.

First, a first invention is a cable connection structure for axially connecting a first cable and a second cable to each other. Axial connection of the first cable and the second cable is performed via a cylindrical connection member that is constrained from axially moving. A connection end portion of the first cable is provided with a radially outwardly projected engagement projection, and a connection end portion of the second cable is formed with an axially extended reception groove that is capable of axially receiving the engagement projection. The first cable is constructed such that when the connection end portion of the first cable is inserted axially into the cylindrical connection member from one side, the engagement projection can be axially received along an insertion groove that is formed in the cylindrical connection member. The insertion groove is shaped such that an axial terminal end portion of the insertion groove into which the engagement projection is inserted is bent in a circumferential direction. When the engagement projection reaches a terminal end position of the insertion groove, the engagement projection is maintained in a condition in which dual-directional axial movement thereof with respect to the connection member is restrained. A reception groove formed in the connection end portion of the second cable is shaped such that an axial terminal end portion of the reception groove into which the engagement projection is inserted is bent in an opposite circumferential direction opposite to the insertion groove. When the connection end portion of the second cable is axially inserted into the cylindrical connection member from the other side thereof, the engagement projection of the first cable retained in the cylindrical connection member is axially received along the reception groove of the second cable. When the engagement projection reaches a terminal end position of the reception groove that is bent in the opposite circumferential direction, the engagement projection is removed from the terminal end position of the insertion groove of the connection member, and as a result, the engagement projection is released from a condition in which axial movement thereof with respect to the connection member is restrained and is placed in a condition in which axial movement thereof with respect to the second cable is restrained. In the condition in which the engagement projection reaches the terminal end position of the reception groove of the second cable and axial movement thereof is restrained, the engagement projection is retained in the terminal end portion of the reception groove by an axially extended portion of the insertion groove that is formed in the connection member, and as a result, the cables can be axially integrally connected so as to axially move while integrated with each other.

According to the first invention as described above, upon insertion of the connection end portion of the first cable into the cylindrical connection member, the engagement projection formed in the connection end portion can be axially received in the insertion groove that is formed in the connection member. When the engagement projection reaches the terminal end position of the insertion groove that is bent in the circumferential direction, the first cable is maintained in the condition in which the dual-directional axial movement thereof with respect to the connection member is restrained.

In the condition in which the first cable is maintained, when the connection end portion of the second cable is axially inserted into the cylindrical connection member from the other side thereof, the engagement projection retained in the terminal end position of the insertion groove is axially received along the reception groove formed in the second cable. When the second cable is further inserted and the engagement projection reaches the terminal end position of the reception groove that is bent in the opposite circumferential direction, the engagement projection is removed from the terminal end position of the insertion groove, and as a result, the first cable is released from the condition in which the axial movement thereof with respect to the connection member is restrained and is placed in the condition in which the first cable is integrally connected to the second cable. At this time, the engagement projection formed in the first cable is retained in the terminal end portion of the reception groove while guided by the axially extended portion of the insertion groove. As a result, the cables can be maintained in the axial connection condition in which the cables are axially integrally connected, so that the second cable can be further axially inserted while the cables are maintained in the axial connection condition.

Next, in a second invention related to the first invention, when the second cable is pulled from the cylindrical connection member in the condition in which the second cable is inserted into the cylindrical connection member and in which the cables are axially integrally connected, the engagement projection of the first cable retained in the terminal end position of the reception groove of the second cable is guided by the terminal end portion of the insertion groove of the connection member that is bent in the circumferential direction, so as to be removed from the terminal end position of the reception groove of the second cable, and as a result, the axial connection condition of the cables can be canceled.

According to the second invention, when the second cable is axially pulled in the axial connection condition of the cables, the engagement projection of the first cable is guided by the curved insertion groove of the connection member, so as to be removed from the terminal end position of the reception groove. As a result, the axial connection condition of the cables can be canceled. That is, when the second cable is inserted into the connection member, the cables can be axially connected to each other. Conversely, when the second cable is pulled from the connection member, the axial connection condition of the cables can be canceled.

Next, in a third invention related to the first or second invention, at least one of the insertion groove formed in the connection member and the reception groove formed in the second cable is shaped such that the terminal end portion thereof is circumferentially smoothly curved.

According to the third invention, the circumferentially bent portions of the insertion groove and the reception groove are shaped such that the terminal end portions thereof are smoothly curved. Therefore, when the second cable is inserted into the cylindrical connection member, the engagement projection of the first cable can be circumferentially smoothly moved along the circumferentially smoothly curved terminal end portions.

Further, in a fourth invention related to any of the first to third inventions described above, a plurality of engagement projections are formed in the first cable so as to be axisymmetrical with each other. Further, a plurality of insertion grooves and reception grooves that receive the engagement projections are respectively axisymmetrically formed in the connection member and the second cable so as to correspond to the engagement projections.

According to the fourth invention, an engagement structure between the engagement projections and the grooves formed in the connection member and the second cable are axisymmetrically formed. Therefore, an engagement force produced by the engagement structure can be circumferentially uniformly applied to the corresponding components.

Next, in a fifth invention related to any of the first to fourth inventions described above, the first cable is disposed in a seat back of a vehicle seat and the second cable is disposed in a tubular stay of a headrest that is attached to an upper portion of the seat back. A cylindrical support into which the stay is inserted is disposed on the upper portion of the seat back as the connection member. When the connection end portion of the first cable is inserted into the cylindrical support from below and the engagement projection formed in the connection end portion is retained in the terminal end position of the insertion groove that is formed in the support, the first cable is maintained in a condition in which the first cable is suspended in the cylindrical support. When the stay is inserted into the cylindrical support from above, the engagement projection of the first cable is received in the reception groove of the second cable inserted into the tubular stay and then reaches the terminal end position of the reception groove, and as a result, the cables can be axially connected, so as to be positioned in the axial connection condition in which the cables can axially move while integrated with each other.

According to the fifth invention, when the stay of the headrest is inserted into the cylindrical support disposed on the upper portion of the seat back, the cables can be axially connected, so as to be positioned in the axial connection condition in which they can axially move while integrated with each other.

Effect of the Invention

The means described above may provide following effects.

First, according to the first invention, the engagement projection formed in the first cable can be retained in the circumferentially curved terminal end positions of the reception groove formed in the second cable. Therefore, connection end portions of the cables can be axially securely connected to each other so as to be prevented from being disengaged from each other.

Further, according to the second invention, when the second cable is drawn out form the connection member, the connection condition of the cables can be canceled. Therefore, the axial connection condition in which the cables are axially securely connected to each other can be released by simple pulling operation.

Further, according to the third invention, the circumferentially bent portion of the insertion groove and the reception groove are respectively shaped so as to be gently curved. Therefore, upon insertion of the cables into the cylindrical connection member, the engagement projection of the first cable can be smoothly moved circumferentially along the circumferentially curved terminal end portions of the grooves.

Further, according to the fourth invention, an engagement structure of the engagement projection formed in the first cable is axisymmetrically formed. Therefore, an engagement force produced by the engagement structure can be circumferentially uniformly applied to the corresponding components. As a result, insertion of the cables can be smoothly performed. In addition, the axial connection condition can be fortified.

Further, according to the fifth invention, the cable connection structure is applied to an attaching portion in which the stay of the headrest is attached to the cylindrical support of the seat back by insertion. Therefore, the cables can be easily axially connected to each other by attaching operation of the headrest that is performed by insertion of the stay.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a vehicle seat according to Embodiment 1, which schematically illustrates construction thereof.

FIG. **2** is a structural diagram, which illustrates a structure in which a push rod is pushed upwardly by an operation cable.

FIG. **3** is an enlarged perspective view, which illustrates an insertion structure in which a stay of a headrest and the operation cable are inserted into a cylindrical support.

FIG. **4** is an enlarged perspective view of a detection device that can detect a vehicle back-side collision.

FIG. **5** is a side view, which illustrates a condition in which a support portion of the headrest is retained in an initial position.

FIG. **6** is a schematic view of internal structure of a headrest moving mechanism, which corresponds to a sectional view taken along line VI-VI of FIG. **11**.

FIG. **7** is a side view, which illustrates a condition in which the support portion of the headrest is moving toward a head.

FIG. **8** is a side view, which illustrates a condition in which the support portion of the headrest reaches a collision preparatory position.

FIG. **9** is a side view, which illustrates a condition in which the support portion of the headrest is moving from the collision preparatory position toward the initial position.

FIG. **10** is a side view, which illustrates a condition in which the support portion of the headrest is moved toward the initial position while it is guided.

FIG. **11** is a structural diagram of the headrest moving mechanism, which is viewed from line XI of FIG. **8**.

FIG. **12** is a perspective view, which illustrates a condition before the stay is inserted into the cylindrical support.

FIG. **13** is a perspective view, which illustrates a condition in which the stay is inserted into the cylindrical support.

FIG. **14** is a sectional view taken along line XIV-XIV of FIG. **13**.

FIG. **15** is a perspective view, which illustrates construction of a cable connection structure according to Embodiment 2.

DESCRIPTION OF SYMBOLS

1 vehicle seat
2 seat back
2F back frame (stationary member)
Fu upper frame
Fs side frame
2S support
Sb knob
St engagement claw
Sd insertion groove
3 seat cushion
4 headrest
4A support portion
4B stay (second cable)
Bk engagement groove
Bd reception groove
4C headrest base portion
10 headrest moving mechanism
11B rear surface portion
11D bottom surface portion
11S side surface portion
11U top surface portion
11R rib
11H elongated hole
H**0** lower end portion
H**1** first stopper groove
H**2** second stopper groove
H**3** upper end portion
12 connection link
12A connection shaft
12B connection shaft
13 support member
13A connection shaft
14 hook
14A connection shaft
14B upper jaw portion
14C lower jaw portion
14D engagement groove
14S torsion spring
15 engagement-disengagement member
15A operation arm portion
15B connection shaft
15C engagement arm portion
15S torsion spring
16 tension spring
17 lever member
17A connection shaft
17B receiving portion
17S torsion spring
20 pressure receiving member
20S torsion spring
21 pressure receiving portion
30 damper
31 rotation shaft
31A connection arm
32 case
32A operation arm
40 operation cable (first cable)
41 inner member
41P engagement projection
42 outer member
42S elongated hole
42H head portion
42D bulged portion
50 push rod
60 attachment bracket
61 outer attaching portion
62 stopper

BEST MODE FOR CARRYING OUT THE INVENTION

In the following, the best mode for carrying out the present invention is described with reference to the drawings.

Embodiment 1

First, construction of a cable connection structure according to Embodiment 1 is described with reference to FIGS. **1** to **14**. As shown in FIG. **1**, the cable connection structure of this embodiment is a connection structure that is constructed to connect two cables disposed within a vehicle seat **1** to each other.

FIG. **1** is a perspective view of the vehicle seat **1**, which schematically illustrates construction thereof. The vehicle seat **1** is composed of a seat back **2** that functions as a back support of a sitting person, a seat cushion **3** that functions as a seating portion, and a headrest **4** that functions as a head support. In the drawings such as FIG. **1**, in order to clarify inner structure of the seat back **2**, the headrest **4** and other components, covering structure thereof is omitted.

The headrest **4** has two rod-shaped stays **4**B and **4**B that are vertically attached to a lower portion thereof. The stays **4**B and **4**B are respectively inserted into insertion ports Sa formed in cylindrical supports **2**S and **2**S that are attached to an upper surface portion of the seat back **2**, so that the headrest **4** is attached to the upper surface portion of the seat back **2**. The supports **2**S and **2**S are integrally secured to an upper frame Fu of a back frame **2**F that constitutes a framework of the seat back **2**. The upper frame Fu is integrally connected to both of side frames Fs and Fs, so as to connect upper end portions of the side frames Fs and Fs.

The headrest **4** is normally retained in its predetermined position, so as to catch the head of the sitting person at a rear side position thereof. However, the headrest **4** is constructed such that when a vehicle back-side collision happens, a support portion **4**A can instantaneously move forwardly, so as to move closer to the head. The support portion **4**A is positioned at a front side of the headrest **4** and is constructed to catch the head. That is, the headrest **4** is constructed such that when the vehicle back-side collision, only the support portion **4**A of the headrest **4** can move to a position immediately behind the back of the head of the sitting person that has a posture in which the body is forwardly spaced from the seat back **2** and the headrest **4**. Thus, when the vehicle back-side collision happens, rearward inclination of the head can be quickly prevented by the support portion **4**A. As a result, a loading applied to the neck can be reduced, so that a whiplash injury can be prevented.

Motion to move the support portion **4**A forwardly when the vehicle back-side collision happens can be performed by a headrest moving mechanism **10** that is incorporated into the headrest **4**. As shown in FIG. **5**, in a normal condition in which the vehicle back-side collision does not yet happen, the headrest moving mechanism **10** retains the support portion **4**A in a posture of an initial position thereof while maintaining the support portion **4**A in a forward movement restraint condition. Further, the support portion **4**A is normally biased in a forward moving direction, i.e., in a direction toward the head, by a tension spring **16** that is positioned between the support portion **4**A and a headrest base portion **4**C integrated with the stays **4**B and **4**B. Therefore, in the normal condition in which the vehicle back-side collision does not yet happen, the support portion **4**A is retained in the initial position against a biasing force of the tension spring **16**.

When the vehicle back-side collision happens and the movement restraint condition of the support portion **4**A is canceled, the headrest moving mechanism **10** can move the support portion **4**A forwardly by the biasing force of the tension spring **16**. At this time, the headrest moving mechanism **10** can move the support portion **4**A forwardly and upwardly along profiles of elongated holes **11**H and **11**H formed in the headrest base portion **4**C which will be described hereinafter. As a result, as shown in FIG. **8**, the support portion **4**A is moved to the position immediately behind the back of the head (a collision preparatory position). The headrest moving mechanism **10** is constructed such that in the condition in which the support portion **4**A is moved to the collision preparatory position, the support portion **4**A cannot be pushed back even if the support portion **4**A is applied with a loading caused by the rearward inclination of the head when the vehicle back-side collision happens. As a result, the head of the sitting person can be stably caught by the support portion **4**A in the collision preparatory position.

Referring to FIG. **1** again, an operation of canceling the movement restraint condition of the support portion **4**A in the initial position as described above can be performed by a push up motion of a push rod **50**. The push rod **50** is inserted into the right side tubular stay **4**B of the headrest **4**, as seen in the drawing.

As shown in FIG. **2**, an upper end portion of the push rod **50** is connected to an engagement-disengagement member **15** that is provided as an operation member of the headrest moving mechanism **10**. Further, a lower end portion of the push rod **50** is connected to an upper end portion of an operation cable **40** that is disposed inside the seat back **2**. Further, the operation cable **40** corresponds to a first cable in the present invention and the stay **4**B described above corresponds to a second cable in the present invention.

As shown in FIG. **4**, a lower end portion of the operation cable **40** is connected to a pressure receiving member **20** that is disposed in the seat back **2**, so that the operation cable **40** can be pulled downwardly when the vehicle back-side collision happens. The pressure receiving member **20** may function as a detection device of the vehicle back-side collision. Further, as shown in FIG. **2**, the operation cable **40** is constructed such that when its lower end portion is pulled, a corresponding operational force is transmitted to its upper end portion in reverse, thereby pushing up the push rod **50**.

Further, when the push rod **50** is pushed up, the engagement-disengagement member **15** is pushed and rotated counterclockwise as seen in the drawing, so that the movement restraint condition of the support portion **4**A can be canceled.

In the following, construction of the above-mentioned detection device of the vehicle back-side collision, i.e., the detection device for pushing up the push rod **50** when the vehicle back-side collision happens, is described.

As shown in FIG. **4**, the bent rod-shaped pressure receiving member **20** is disposed in the seat back **2** so as to be positioned in a middle portion thereof. The pressure receiving member **20** is positioned so as to extend in a width direction. A right end portion of the pressure receiving member **20** as seen in the drawing is rotatably supported on a right side frame Fs of the seat back **2**. Further, a left end portion of the pressure receiving member **20** as seen in the drawing is rotatably supported on a left side frame Fs via a rotary type damper **30**.

Formed in a widthwise middle portion of the pressure receiving member **20** is a pressure receiving portion **21** that capable of receiving a seat back loading applied by the sitting person. The pressure receiving portion **21** is formed by bending the right end portion of the pressure receiving member **20** downwardly as seen in the drawing, so as to be offset from a rotation center thereof. Thus, when the pressure receiving portion **21** is pressed rearwardly by the seat back loading applied by the sitting person, the pressure receiving member **20** can be rotated about the both end portions thereof.

Further, a torsion spring **20**S is disposed between the right end portion of the pressure receiving member **20** and the side frame Fs. The torsion spring **20**S is disposed while it is previously twisted, thereby rotationally biasing the pressure receiving member **20** in such a direction as to push the pressure receiving portion **21** forwardly. As a result, the pressure receiving member **20** is normally maintained in a postural condition in which the pressure receiving portion **21** is pressed against a cushion pad (not shown) that is attached to a seat back surface of the seat back **2**.

Further, a well-known rotary type damper is used as the damper **30** that is connected to the left end portion of the pressure receiving member **20**. That is, in the damper **30**, a rotation shaft **31** is inserted into a cylindrical case **32**. The rotation shaft **31** and the case **32** are assembled so as to be rotated relative to each other.

The rotation shaft **31** has a connection arm **31**A that is attached to a right end portion thereof as seen in the drawing. The connection arm **31**A is integrally connected to the left end portion of the pressure receiving member **20**. Further, a left end portion of the rotation shaft **31** as seen in the drawing is rotatably supported by the left side frame Fs. Thus, the case **32** is supported by the rotation shaft **31**, so as to be rotatable with respect to the side frame Fs. Further, the case **32** has an operation arm **32**A that is attached to an outer circumferential surface thereof. The operation arm **32**A is connected to a lower end portion of an inner member **41** of the operation cable **40** which will be described hereinafter. The case **32** is constructed such that when the operation arm **32**A contacts a stopper **62** of an attachment bracket **60** that is attached to the side frame Fs, its movement in such a direction as to contact the stopper **62** can be restrained.

The case **32** described above is filled with a viscous fluid such as silicone oil and is hermetically sealed. As a result, when the rotation shaft **31** is urged to rotate relative to the case **32**, a viscous resistance is produced therebetween dependent upon a rotating speed thereof. This viscous resistance is applied between the rotation shaft **31** and the case **32**. The viscous resistance is increased as the rotating speed of the rotation shaft **31** is increased. Conversely, the viscous resistance is decreased as the rotating speed of the rotation shaft **31** is decreased. When the applied viscous resistance is large, a rotational force of the rotation shaft **31** can be easily transmitted to the case **32**. Conversely, when the applied viscous resistance is small, the rotational force of the rotation shaft **31** cannot be not easily transmitted to the case **32**.

When the sitting person reclines against the seat back **2**, the pressure receiving member **20** and the damper **30** thus constructed may operate as follows.

First, in the normal condition in which the vehicle back-side collision does not yet happen, when the sitting person reclines against the seat back **2**, the pressure receiving member **20** is pushed and rotated rearwardly at a relatively gentle speed corresponding to behavior of the sitting person. Therefore, in this case, the rotation shaft **31** can rotate relative to the case **32** at a relatively gentle speed, so that the applied viscous resistance is small. As a result, the rotation shaft **31** idles within the case **32**, so that the rotational force of the rotation shaft **31** can not be transmitted to the case **32**.

However, when the vehicle back-side collision happens, the sitting person is sharply pressed against the seat back **2** by impact of the collision. At this time, the pressure receiving member **20** is pushed and rotated rearwardly at a relatively high speed corresponding to impulsive motion of the setting person. Therefore, in this case, the rotation shaft **31** can relatively rotate at a relatively high speed, so that the applied viscous resistance is large. As a result, the rotational force of the rotation shaft **31** can be transmitted to the case **32**, so that the case **32** can rotate integrally with the rotation shaft **31**. Thus, the case **32** can pull the lower end portion of the inner member **41** of the operation cable **40** downwardly because the lower end portion of the inner member **41** is connected to the operation arm **32**A.

Further, when the lower end portion of the inner member **41** of the operation cable **40** is pulled, as shown in FIG. **2**, the corresponding operational force is transmitted to an upper end portion of the inner member **41**, so that the push rod **50** is pushed up within the support **2**S.

Next, a transmission mechanism of the operational force transmitted from the operation cable **40** to the push rod **50** is described.

The operation cable **40** has a double layer structure in which the linear inner member **41** is inserted into a flexible tubular outer member **42**. The inner member **41** has flexibility greater than the outer member **42**. As shown in FIG. **3**, the operation cable **40** is disposed inside the seat back **2**, and the lower end portion of the inner member **41** is connected to the operation arm **32**A of the damper **30** as described above. Further, a lower end portion of the outer member **42** is connected to an outer attaching portion **61** of the attachment bracket **60** that is attached to the left side frame Fs as seen in the drawing. Thus, the operation cable **40** is constructed such that the lower end portion of the inner member **41** is pulled from the lower end portion of the outer member **42** when the vehicle back-side collision happens.

As shown in FIGS. **2** and **3**, upon insertion of the upper end portion of the operation cable **40** into the support **2**S from below, the operation cable **40** can be assembled to the support **2**S so as to push the push rod **50** disposed in the cylindrical stay **4**B that is inserted into the cylindrical support **2**S.

In particular, as shown in FIG. **3**, the operation cable **40** is constructed such that T-shaped engagement projections **41**P and **41**P formed in the upper end portion of the inner member **41** are projected radially outwardly from elongated through holes **42**S and **42**S that are formed in a circumferential wall of the upper end of the outer member **42**.

As a result, the inner member **41** can axially move relative to the outer member **42** within a range corresponding to a range that the T-shaped engagement projections **41**P and **41**P can move within the elongated holes **42**S and **42**S. The engagement projections **41**P and **41**P and the elongated holes **42**S and **42**S are axisymmetrically formed in two circumferential positions of the inner member **41** and the outer member **42**. A head portion **42**H is formed in an upper end portion of the outer member **42**, so as to close a tubular end portion thereof.

As shown in FIG. **12**, when the upper end portion of the operation cable **40** thus constructed is inserted into the cylindrical the support **2**S from below, the operation cable **40** is temporarily retained while the upper end portion thereof is suspended from the support **2**S. In this suspended condition, as shown in FIG. **13**, upon insertion of the stay **4**B into the cylindrical support **2**S from above, the operation cable **40** can be transferred from a condition in which the operation cable **40** is suspended from the support **2**S to a condition in which the operation cable **40** is suspended from the stay **4**B.

Further, when the operation cable **40** is in the condition in which it is suspended from the stay **4**B, the operation cable **40** is in a condition in which the operation cable **40** can transmit the operational force produced from the lower end thereof being pulled to the push rod **50** positioned inside the stay **4**B in reverse as a pushing operational force.

The construction described above is described in detail with reference to FIG. **3**. First, formed in a circumferential wall of the support **2**S are slot-shaped insertion grooves Sd and Sd that extend axially upwardly from a lower end portion of the support **2**S. The insertion grooves Sd and Sd are positioned in two circumferential positions of the support **2**S so as to be axisymmetrical with each other. The insertion grooves Sd and Sd are respectively shaped such that the engagement projections **41**P and **41**P formed in the inner member **41** of the operation cable **40** can be received therein and can be inserted thereinto in an axial direction.

The insertion grooves Sd and Sd are respectively shaped such that terminal end portions corresponding to upper end sides thereof that receive the engagement projections **41**P and **41**P are respectively circumferentially curved leftwardly and rightwardly as seen in the drawings. In particular, the insertion groove Sd positioned in a near side in FIG. **3** and shown by solid lines is shaped such that the terminal end portion thereof is gently curved leftwardly as seen in the drawing. Conversely, the insertion groove Sd positioned in a far side in FIG. **3** and shown by broken lines is shaped such that the terminal end portion thereof is curved rightwardly as seen in the drawing. That is, the insertion groove Sd positioned in the far side in FIG. **3** is shaped so as to be axisymmetrical with the insertion groove Sd positioned in the near side in FIG. **3**.

Each of the circumferentially curved terminal end portions of the insertion grooves Sd and Sd is shaped so as to be positioned below a horizontal level line. As a result, when the engagement projections **41**P and **41**P (the operation cable **40**) are inserted into the insertion grooves Sd and Sd until they reach terminal end positions thereof, the engagement projections **41**P and **41**P are stably retained while suspended from the support **2**S, so as to be prevented from falling therefrom under their own weight.

The operation cable **40** can be inserted into the cylindrical support **2**S by simply inserting the same upwardly (axially) after the engagement projections **41**P and **41**P attached to the upper end portion of the inner member **41** are inserted into the insertion grooves Sd and Sd. Further, when the engagement projections **41**P and **41**P reach the axial terminal end positions of the insertion grooves Sd and Sd, the operation cable **40** is circumferentially rotated along to the curved terminal end portions. Thus, as shown in FIG. **12**, the engagement projections **41**P and **41**P reach the circumferentially curved terminal end positions of the insertion grooves Sd and Sd, so that the operation cable **40** can be retained while suspended from the support **2**S.

Referring to FIG. **3** again, the upper end portion of the outer member **42** is integrally formed from a synthetic resin, so as to have a bulged portion **42**D that is partially bulged radially outwardly. The bulged portion **42**D is positioned at an axial mid point of the upper end portion of the outer member **42** that is inserted into the cylindrical support **2**S. The bulged portion **42**D is formed over the entire circumference thereof and has a serration shape. The bulged portion **42**D is formed to have an outer diameter substantially equal to an inner diameter of the cylindrical support **2**S. Therefore, because the bulged portion **42**D can be gently fitted into the cylindrical support **2**S when the upper end portion of the operation cable **40** is inserted into the cylindrical support **2**S, the operation cable **40** can be smoothly inserted without swinging within the cylindrical support **2**S.

Further, as shown in FIG. **12**, slot-shaped reception grooves Bd and Bd are formed in a circumferential wall of the stay **4**B that is inserted into the cylindrical support **2**S from above. The reception grooves Bd and Bd are formed so as to extend axially upwardly from an lower end portion of the stay **4**B. The reception grooves Bd and Bd are positioned in two circumferential positions of the stay **4**B so as to be axisymmetrical with each other. When the stay **4**B is inserted into the cylindrical support **2**S from above, the reception grooves Bd and Bd may receive the engagement projections **41**P and **41**P of the inner member **41** of the operation cable **40** that is suspended in the cylindrical support **2**S. Further, when the stay **4**B is further inserted into the support **2**S after the engagement projections **41**P and **41**P are received in the reception grooves Bd and Bd, the engagement projections **41**P and **41**P are introduced upwardly (axially) along the reception grooves Bd and Bd.

The reception grooves Bd and Bd that receive the engagement projections **41**P and **41**P are respectively shaped such that terminal end portions corresponding to upper end sides thereof are circumferentially curved in opposite directions to the insertion grooves Sd and Sd formed in the support **2**S described above. Each of the curved terminal end portions of the reception grooves Bd and Bd is shaped so as to be gently curved from an axial direction to a horizontal direction. As a result, when the stay **4**B is inserted into the cylindrical support **2**S, the engagement projections **41**P and **41**P positioned in the cylindrical support **2**S can be smoothly received in the reception grooves Bd and Bd by a push-in operational force axially applied to the stay **4**B until they reach the terminal end positions of the reception grooves Bd and Bd that are directed horizontally.

Therefore, as shown in FIG. **13**, when the stay **4**B is inserted into the cylindrical support **2**S from above, the engagement projections **41**P and **41**P are circumferentially rotated while guided by the curved portion of the reception grooves Bd and Bd formed in the stay **4**B. As a result, the engagement projections **41**P and **41**P are pushed back from a condition in which the engagement projections **41**P and **41**P are retained in the terminal end positions of the insertion grooves Sd and Sd and are moved in such a direction as to be released from this condition. When the engagement projections **41**P and **41**P move along the curved portions of the reception grooves Bd and Bd and reach the terminal end positions thereof, the engagement projections **41**P and **41**P are pushed back to axially extended portions of the insertion grooves Sd and Sd.

Thus, the engagement projections **41**P and **41**P are transferred from the condition in which they are suspended from the support **2**S such that axial movement thereof is restrained to the condition in which they are suspended from the stay **4**B. As a result, the engagement projections **41**P and **41**P are placed in a condition in which their axial movement with respect to the stay **4**B is restrained. That is, the engagement projections **41**P and **41**P are released from the axial movement restraint condition in which their axial movement with respect to the support **2**S is restrained, so as to be placed in the condition in which their axial movement with respect to the stay **4**B is restrained.

At this time, because the engagement projections **41**P and **41**P are positioned in the axially extended portions of the insertion grooves Sd and Sd, the engagement projections **41**P and **41**P are placed in a condition in which their circumferential movement with respect to the support **2**S is restrained. As a result, the engagement projections **41**P and **41**P are retained in the terminal end positions of the reception grooves Bd and Bd while guided by the axially extended insertion grooves Sd and Sd. Thus, the inner member **41** of the operation cable **40** and the stay **4**B are axially integrally connected to each other, so as to be placed in a condition in which they can axially move together with each other with respect to the support **2**S.

As shown in FIG. **14**, disposed in the cylindrical support **2**S is a plate-shaped engagement claw St that is capable of engaging recess-shaped engagement grooves Bk that are formed in the outer circumferential wall of the stay **4**B. The engagement claw St is normally applied with a biasing force and is maintained in a postural condition in which the engagement claw St is projected into the cylindrical support **2**S. The engagement claw St can be retracted from the cylindrical support **2**S by pushing a knob Sb from the side.

Thus, when a insertion position of one of the engagement grooves Bk is aligned with the engagement claw St upon insertion of the stay **4**B into the cylindrical support **2**S, the engagement claw St enters and engages the corresponding engagement groove Bk by the biasing force. As a result, the stay **4**B is placed in a condition in which the stay **4**B is restrained from moving in an inserting direction, so as to be locked The condition in which the stay **4**B is restrained from moving in the inserting direction can be canceled by disengaging the engagement claw St from the engagement groove Bk by pushing the knob Sb. The engagement grooves Bk are formed in a plurality of positions in the axial direction of the stay **4**B. Therefore, height of the headrest **4** can be freely adjusted by appropriately performing pushing operation of the knob Sb.

As described above, upon insertion of the stay **4**B, the lower end portion of the stay **4**B and the upper end portion of the inner member **41** are axially connected to each other, thereby providing a condition in which the head portion **42**H of the outer member **42** of the operation cable **40** is inserted into the cylindrical stay **4**B from below. As a result, the head portion **42**H of the outer member **42** is axially positioned closer to the lower end portion of the push rod **50** that is inserted in the cylindrical stay **4**B.

Strictly speaking, a small gap is formed between the lower end portion of the push rod **50** and the head portion **42**H such that the push rod **50** cannot be erroneously pushed by the head portion **42**H of the outer member **42** when the stay **4**B is inserted.

Further, in a condition in which the head portion **42**H of the outer member **42** and the lower end portion of the push rod **50** are axially positioned closer to each other, the head portion **42**H and the push rod **50** is in an axial connection condition in which the operational force produced from the lower end of the operation cable **40** being pulled can be reversed by the head portion **42**H of the outer member **42** and be transmitted to the push rod **50** as the pushing operational force.

Further, the above-described headrest **4** can be detached from the seat back **2** by pulling the stays **4**B and **4**B from the cylindrical the supports **2**S and **2**S. At this time, as the stays **4**B and **4**B are drawn out, an axial connection condition of the inner member **41** and the lower end portion of the stay **4**B as described above is canceled.

In particular, as will be recognized from FIG. **13**, as the stay **4**B is upwardly pulled from the support **2**S, the engagement projections **41**P and **41**P are circumferentially rotated while guided by the curved portion of the insertion grooves Sd and Sd of the support **2**S. As a result, the engagement projections **41**P and **41**P are pushed back from a condition in which the engagement projections **41**P and **41**P are retained in the terminal end positions of the reception grooves Bd and Bd and are moved in such a direction as to be removed from this condition. When the engagement projections **41**P and **41**P move along the curved portions of the insertion grooves Sd and Sd and reach the terminal end positions thereof, the engagement projections **41**P and **41**P are pushed back to axially extended portions of the reception grooves Bd and Bd. As a result, as shown in FIG. **12**, the engagement projections **41**P and **41**P are transferred again from the condition in which they are suspended from the stay **4**B to the condition in which they are suspended from the support **2**S. Thus, the axial connection condition of the head portion **42**H of the outer member **42** of the operation cable **40** and the push rod **50** in which they are positioned closer to each other can be canceled.

Next, the headrest moving mechanism **10** is described. While construction of the headrest moving mechanism **10** is shown in FIGS. **5** to **11**, the construction is best shown in FIG. **8**. Therefore, the construction is described with reference to this drawing.

The headrest moving mechanism **10** is arranged such that the support portion **4**A is connected to the headrest base portion **4**C. The headrest moving mechanism includes a pair of connection links **12** and **12** that are laterally positioned, support members **13** and **13**, hooks **14** and **14**, an engagement-disengagement member **15**, the tension spring **16** and lever members **17** and **17**.

The headrest base portion **4**C is made of a synthetic resin. The headrest base portion **4**C has a plate-shaped rear surface portion **11**B, a bottom surface portion **11**D, side surface portions **11**S and **11**S and a top surface portion **11**U that are integrally formed. In particular, the bottom surface portion **11**D extends forwardly from a lower end edge of the rear surface portion **11**B. Further, the side surface portions **11**S and **11**S are vertically positioned on widthwise both sides of the headrest base portion **4**C. Further, the top surface portion **11**U connects upper edges of the side surface portions **11**S and **11**S.

FIG. **11** is a view that is viewed from line XI of FIG. **8**, that is, a front view of the headrest **4** that is viewed from obliquely below. As shown in the drawing, a plurality of upright plate-shaped ribs **11**R-- (A symbol "--" means a plural number.) are formed between the side surface portions **11**S and **11**S of the headrest base portion **4**C, so as to reinforce the headrest base portion **4**C. The ribs **11**R-- are vertically positioned in parallel.

Upper end portions of the stays **4**B and **4**B are respectively inserted into the bottom surface portion **11**D of the headrest base portion **4**C, and are integrally fixed thereto. Further, the stays **4**B and **4**B have tubular shapes and are secured to the bottom surface portion **11**D such that opened upper end portions thereof are exposed to an upper surface side of the bottom surface portion **11**D.

Further, wave-shaped elongated holes **11**H are formed in the side surface portions **11**S and **11**S of the headrest base portion **4**C. The elongated holes **11**H and **11**H are formed by cutting out the side surface portions **11**S and **11**S in a thickness direction thereof. The elongated holes **11**H and **11**H have first stopper grooves H**1** and second stopper grooves H**2** that are formed between lower end portions H**0** and H**0** and upper end portions H**3** and H**3**. The first stopper grooves H**1** and the second stopper grooves H**2** are depressed rearwardly (rightwardly in the drawings) in a wave-like and step-like fashion.

Next, referring to FIG. **8** again, a pair of connection links **12** and **12** are made of a synthetic resin. The connection links **12** and **12** may function as connection members that link the headrest base portion **4**C and the support portion **4**A to each other. The connection links **12** and **12** are positioned on the support portion **4**A so as to be laterally spaced from each other, and their end portions are respectively connected to an upper end portion of the headrest base portion **4**C and a rear surface of the support portion **4**A.

In particular, the rear end portions of the connection links **12** and **12** are rotatably supported by a connection shaft **12**A that passes through the side surface portions **11**S and **11**S of the headrest base portion **4**C. Further, as shown in FIG. **11**, the rear end portions of the connection links **12** and **12** are positioned between the side surface portions **11**S and **11**S and the ribs **11**R and **11**R positioned inside thereof. Thus, the connection links **12** and **12** are rotatably supported by the connection shaft **12**A that extends between the side surface portions **11**S and **11**S.

Referring to FIG. **8** again, the front end portions of the connection links **12** and **12** are rotatably supported by a connection shaft **12**B that is laterally positioned on the rear surface of the support portion **4**A. The connection shafts **12**A and **12**B are positioned so as to be parallel to each other.

The above-described connection links **12** and **12** are arranged, when rotated clockwise about the connection shaft **12**A that rotatably supports the rear end portions thereof, to contact the top surface portion **11**U of the headrest base portion **4**C, so that their clockwise rotation can be restrained.

Next, a pair of support members **13** and **13** are integrally connected to the support portion **4**A so as to extend rearwardly from the rear surface of the support portion **4**A. The support members **13** and **13** are positioned on the support portion **4**A so as to be laterally spaced from each other. The support portion **4**A is made of a synthetic resin. Further, the support portion **4**A is integrally formed such that a front surface thereof has a curved plate-shape. Further, the rear surface of the support portion **4**A is integrally formed with support portions for rotatably supporting the connection shaft **12**B. Also, the rear surface of the support portion **4**A is integrally formed with the support members **13** and **13**.

Rear end portions of the support members **13** and **13** are connected to each other by a connection shaft **13**A that extends in a width direction. In particular, as shown in FIG. **11**, the rear end portions of the support members **13** and **13** are positioned between the ribs **11**R and **11**R positioned outside thereof and the ribs **11**R, **11**R positioned inside thereof. Further, the connection shaft **13**A that connects the rear end portions of the support members **13** and **13** is positioned so as to be parallel to the connection shaft **12**A and the connection shaft **12**B described above.

End portions of the connection shaft **13**A are passed through the elongated holes **11**H and **11**H that are formed in the side surface portions **11**S and **11**S of the headrest portion **4**C. Therefore, the connection shaft **13**A is capable of moving back and forth and up and down only within a range defined by the profiles of elongated holes **11**H and **11**H. Further, the ribs **11**R-- (FIG. **11**) that are formed between the side surface portions **11**S and **11**S are shaped so as to not interfere with the connection shaft **13**A that moves within the elongated holes **11**H and **11**H.

Next, as shown in FIG. **6**, a pair of hooks **14** and **14** are formed to cam shapes as a whole and are disposed in the headrest base portion **4**C. The hooks **14** and **14** are positioned at a lower end portion of the headrest base portion **4**C so as to be laterally spaced from each other. The hooks **14** and **14** are provided as restraint members that are capable of restraining movement of the connection shaft **13**A moving within the elongated holes **11**H and **11**H at an initial position thereof.

In particular, as shown in FIG. **11**, the hooks **14** and **14** are positioned between the side surface portions **11**S and **11**S and the ribs **11**R and **11**R positioned inside thereof and are respectively rotatably supported by connection shafts **14**A and **14**A that extend therebetween.

Referring to FIG. **6** again, formed in each of the hooks **14** and **14** is a claw-shaped upper jaw portion **14**B and a claw-shaped lower jaw portion **14**C that extend radially outwardly thereof. Each of the upper jaw portion **14**B and the lower jaw portion **14**C is positioned in two positions on outer circumferential portions of the hook **14**. As a result, formed between the upper jaw portions **14**B and **14**B and the lower jaw portions **14**C and **14**C are recesses that are depressed radially inwardly. The recesses formed between the upper jaw portions **14**B and the lower jaw portions **14**C are shaped such that the above-mentioned connection shaft **13**A can be receive therein. The connection shafts **14**A and **14**A are positioned so as to be parallel to the connection shafts **12**A and **12**B and the connection shaft **13**A.

Further, torsion springs **14**S and **14**S are disposed between the hooks **14** and **14** and the headrest base portion **4**C described above. The torsion springs **14**S and **14**S are disposed while they are previously twisted. The hooks **14** and **14** are biased by the torsion springs **14**S and **14**S so as to be rotated counterclockwise from a position shown in FIG. **6**.

Further, step-shaped engagement grooves **14**D are formed in the outer circumferential portions of the hooks **14** and **14**. The engagement grooves **14**D and **14**D engage a pair of engagement arm portions **15**C and **15**C that are formed in the engagement-disengagement member **15** which will be described hereinafter. Thus, the hooks **14** and **14** can be maintained in a condition in which counterclockwise rotation thereof by biasing forces is restrained.

Therefore, in the condition in which the counterclockwise rotation of the hooks **14** and **14** is restrained, the hooks **14** and **14** can maintain the connection shaft **13**A in a condition in which the connection shaft **13**A is retained in the lower end portions H**0** and H**0** of the elongated holes **11**H and **11**H while the connection shaft **13**A is received in the recesses formed between the upper jaw portions **14**B and **14**B and the lower jaw portions **14**C and **14**C.

As shown in FIG. **5**, the connection shaft **13**A is normally biased toward the connection shaft **12**A by the tension spring **16** that is disposed between the connection shaft **13**A and the connection shaft **12**A, so as to be biased toward the upper end portions H**3** and H**3** along the profiles of the elongated holes **11**H and **11**H. Thus, the connection shaft **13**A is normally maintained in the condition (an initial condition) in which the connection shaft **13**A is retained in the lower end portions H**0** and H**0** of the elongated holes **11**H and **11**H by the hooks **14** and **14** against the biasing force of the tension spring **16**.

Further, referring to FIG. **6** again, when the engagement arm portions **15**C and **15**C are disengaged from the hooks **14** and **14** upon counterclockwise rotation thereof, the hooks **14** and **14** can rotate counterclockwise by biasing forces of the torsion springs **14**S and **14**S. As a result, as indicated by broken lines in FIG. **6**, the upper jaw portions **14**B and **14**B of the hooks **14** and **14** are moved out of the elongate holes **11**H and **11**H, and the lower jaw portions **14**C and **14**C are pushed up from below, so as to be exposed to the elongated holes **11**H and **11**H. Thus, the condition in which the connection shaft **13**A is retained by the hooks **14** and **14** is canceled. As a result, as shown in FIGS. **7** and **8**, the connection shaft **13**A moves forwardly and upwardly along the profiles of the elongated holes **11**H and **11**H by the biasing force of the tension spring **16**. As a result, the support portion **4**A relatively moves forwardly and upwardly with respect to the headrest base portion **4**C while rotating the connection links **12** and **12**.

Referring to FIG. **6** again, the engagement arm portions **15**C and **15**C that can restrain the counterclockwise rotation of the hooks **14** and **14** are positioned so as to be laterally spaced from each other, and are positioned so as to be capable of engaging the hooks **14** and **14**. In particular, as shown in FIG. **11**, similar to the hooks **14** and **14**, the engagement arm portions **15**C and **15**C are positioned between the side surface portions **11**S and **11**S and the ribs **11**R and **11**R positioned inside thereof. Further, the engagement arm portions **15**C and **15**C are rotatably supported by a connection shaft **15**B that extends between the side surface portions **11**S and **11**S. The connection shaft **15**B is integrally connected to the engagement arm portions **15**C and **15**C and is rotatably supported by the side surface portions **11**S and **11**S. The connection shaft **15**B is positioned so as to be parallel to the connection shafts **12**A and **12**B and the connection shaft **13**A.

Further, a torsion spring **15**S is dispose between one of the engagement arm portions **15**C and the headrest base portion **4**C. The torsion spring **15**S is disposed while it is previously twisted. As shown in FIG. **6**, the torsion spring **15**S biases the engagement arm portions **15**C and **15**C clockwise. Thus, the engagement arm portions **15**C and **15**C are normally maintained in a condition in which they are pressed to the outer circumferential portions of the hooks **14** and **14** while distal ends of the engagement arm portions **15**C and **15**C respectively engage the step-shaped engagement grooves **14**D and **14**D. When the engagement arm portions **15**C and **15**C engage the engagement grooves **14**D and **14**D, the engagement arm portions **15**C and **15**C and the engagement grooves **14**D and **14**D are oppositely contact each other, so that biased rotation thereof are mutually restrained.

Further, referring to FIG. **5** again, an operation arm portion **15**A is integrally connected to an end portion of the connection shaft **15**B that is connected to the engagement arm portions **15**C and **15**C described above. The operation arm portion **15**A is arranged so as to be rotated by the push rod **50** described above. When the vehicle back-side collision happens and the push rod **50** is pushed upwardly, the operation arm portion **15**A is rotated counterclockwise. As a result, as shown in FIG. **6**, the operation arm portion **15**A rotates the engagement arm portions **15**C and **15**C in the same direction, thereby disengaging the engagement arm portions **15**C and **15**C from the hooks **14** and **14**. Thus, a condition in which the support portion **4**A is retained in the initial position can be canceled, so that the support portion **4**A is transferred forwardly and upwardly by the biasing force of the tension spring **16**.

As shown in FIG. **8**, forward and upward movement of the support portion **4**A is restrained and stopped when the connection shaft **13**A reaches the upper end portions H**3** and H**3** of the elongated holes **11**H and **11**H. Further, in a condition in which the movement of the support portion **4**A is stopped, the support portion **4**A cannot be pushed back rearwardly even if the support portion **4**A is applied with a loading from the head of the sitting person.

That is, when the connection shaft **13**A reaches the upper end portions H**3** and H**3** of the elongated holes **11**H and **11**H, the connection links **12** and **12** connected to the supported portion **4**A contact the top surface portion **11**U of the headrest base portion **4**C, so as to become a condition in which clockwise rotation thereof is restrained. In the condition in which the clockwise rotation of the connection links **12** and **12** is restrained, when the support portion **4**A is applied with a force that urges the same to move rearwardly, the connection links **12** and **12** are applied with a force that urges the same to press against the top surface portion **11**U of the headrest base portion **4**C. Therefore, even if the support portion **4**A is applied with a pressing force as described above, the support portion **4**A is prevented from being rotated counterclockwise. As a result, the support portion **4**A can catch the head of the sitting person in the collision preparatory position.

Further, as shown in FIG. **7**, the support portion **4**A can be prevented from being pushed back rearwardly if it is pressed by the head of the sitting person while it is moving forwardly. That is, when the connection shaft **13**A is applied with a force that urges the same to move rearwardly while the support portion **4**A is moving forwardly, the connection shaft **13**A can enter the first stopper grooves H**1** and H**1** or the second stopper grooves H**2** and H**2** that are formed in the elongated holes **11**A and **11**A so as to be depressed rearwardly (rightwardly in the drawings) in the step-like fashion. As a result, rearward movement of the connection shaft **13**A is restrained, so that the support portion **4**A can be maintained in positions on the way of forward movement thereof. Therefore, even when the support portion **4**A does not yet reach the collision preparatory position, the head of the sitting person can be caught by the support portion **4**A. Further, FIG. **7** shows a condition in which the connection shaft **13**A is placed in the second stopper grooves H**2** and H**2**.

Referring to FIG. **5** again, attached to the headrest base portion **4**C are a pair of lever members **17** and **17** that are formed by arm-shaped members. The lever members **17** and **17** are positioned so as to be laterally spaced from each other, and their rear end portions are respectively rotatably connected to the headrest base portion **4**C.

In particular, as shown in FIG. **11**, the rear end portions of the lever members **17** and **17** are positioned between the outer ribs **11**R and **11**R and the inner ribs **11**R and **11**R and are respectively rotatably supported by connection shafts **17**A and **17**A that extend therebetween.

Further, torsion springs **17**S and **17**S are disposed between the lever members **17** and **17** and the headrest base portion **4**C. As shown in FIG. **5**, the torsion springs **17**S and **17**S are wound around the connection shafts **17**A and **17**A. One end of each of the torsion springs **17**S and **17**S is connected to each of the lever members **17** and **17**. The other end of each of the torsion springs **17**S and **17**S is connected to the headrest base portion **4**C. Thus, in their free conditions, the lever members **17** and **17** are maintained in a postural condition in which they are exposed to the elongated holes **11**H and **11**H by spring forces of the torsion springs **17**S and **17**S.

Spoon-shaped receiving portions **17**B are respectively formed in left or forward end portions of the lever members **17** and **17** that are exposed to the elongated holes **11**H and **11**H. As shown in FIG. **7**, when the connection shaft **13**A moves upwardly from the lower ends H**0** and H**0** within the elongated holes **11**H and **11**H, the receiving portions **17**B and **17**B are pushed away by the connection shaft **13**A, so as to be pushed out of the elongated holes **11**H and **11**H. However, as shown in FIG. **8**, when the connection shaft **13**A reaches the upper end portions H**3** and H**3** of the elongated holes **11**H and **11**H, the receiving portions **17**B and **17**B are returned to the postural condition in which they are exposed to the elongated holes **11**H and **11**H by the spring forces of the torsion springs **17**S and **17**S.

Further, as shown in FIG. **9**, when the connection shaft **13**A is transferred within the elongated holes **11**H and **11**H downwardly from the upper end portions H**3** and H**3**, the receiving portions **17**B and **17**B catch the connection shaft **13**A by their spoon-shaped distal ends. Further, when, in this condition, the connection shaft **13**A is further transferred downwardly, the lever members **17** and **17** are pushed and rotated counterclockwise in the drawing while pressed by the connection shaft **13**A that is caught by the receiving portions **17**B and **17**B.

As shown in FIG. **10**, the connection shaft **13**A, when transferred to a portion closer to the lower end portions H**0** and H**0** while guided by the lever members **17** and **17**, is disengaged from the receiving portions **17**B and **17**B. Thus, the connection shaft **13**A, when transferred downwardly from the upper end portions H**3** and H**3** within the elongated holes **11**H and **11**H, is smoothly transferred to the lower end portions H**0** and H**0** while guided by the lever members **17** and **17**, so as to not enter the first stopper grooves H**1** and H**1** or the second stopper grooves H**2** and H**2**.

Further, because the connection shaft **13**A is operated so as to be pressed toward the lower end portions H**0** and H**0** of the elongated holes **11**H and **11**H, the connection shaft **13**A reaches the lower end portions H**0** and H**0** while pressing down the lower jaw portions **14**C and **14**C of the hooks **14** and **14** that are exposed to the lower end portions H**0** and H**0**. As a result, as shown in FIG. **6**, the hooks **14** and **14** are rotated clockwise in the drawing, so as to be placed in a postural condition in which the upper jaw portions **14**B and **14**B thereof are positioned over the upper side of the connection shaft **13**A.

The hooks **14** and **14**, when placed in the condition as described above, engage the engagement arm portions **15**C and **15**C, so as to be is locked again in a condition in which the connection shaft **13**A is maintained in the initial position. As a result, the support portion **4**A is maintained again in a condition in which it is returned to the posture of the initial position thereof, i.e., a position before it is moved forwardly.

Next, a method of using the embodiment is described.

Referring to FIG. **1**, in the normal condition in which the vehicle back-side collision does not yet happen, the vehicle seat **1** is in a condition in which the support portion **4**A of the headrest **4** is maintained in the posture of the initial position thereof. When the vehicle back-side collision happens, the pressure receiving portion **21** is pressed rearwardly by the seat back loading applied by the sitting person. As a result, a corresponding operational force is transferred via the operation cable **40** and the push rod **50**, so that the engagement-disengagement member **15** is rotated.

Thus, the support portion **4**A is released from a condition in which it is retained in the initial position. As a result, as shown in FIG. **8**, the support portion **4**A moves to the collision preparatory position by the biasing force of the tension spring **16**. Further, the support portion **4**A that is moved to the collision preparatory position can receive the head of the sitting person that is inclined rearwardly by the impact of the collision from a back-side of the head.

Thus, according to the cable connection structure of the embodiment, upon insertion of the stay **4**B into the cylindrical support **2**S, the engagement projections **41**P and **41**P formed in the first cable (the inner member **41** of the operation cable **40**) can be retained in the circumferentially curved terminal end positions of the reception grooves Bd and Bd formed in the second cable (the stay **4**B). Therefore, connection end portions of the cables can be securely connected to each other so as to be prevented from being disengaged from each other.

Further, when the stay **4**B as the second cable is drawn out form the support **2**S, the axial connection condition of the inner member **41** and the stay **4**B can be canceled. Therefore, the axial connection condition in which the stay **4**B and the inner member **41** are axially securely connected to each other can be released by simply removing the stay **4**B from the support **2**S.

Further, the insertion grooves Sd and Sd and the reception grooves Bd and Bd are respectively shaped so as to be gently curved circumferentially. Therefore, upon insertion of the operation cable **40** and the stay **4**B into the cylindrical support **2**S, the engagement projections **41**P and **41**P can be smoothly moved circumferentially along the circumferentially curved terminal end portions of the grooves.

Further, an engagement structure of the engagement projections **41**P and **41**P are axisymmetrically formed. Therefore, an engagement force produced by the engagement structure can be circumferentially uniformly applied to the corresponding components such as the support **2**S and the stay **4**B. As a result, insertion of the operation cable **40** and the stay **4**B can be smoothly performed. In addition, the axial connection condition can be fortified.

Further, the cable connection structure is applied to an attaching portion in which the stay **4**B is attached to the cylindrical support **2**S by insertion. Therefore, the cables can be easily axially connected to each other by removing-attaching operation of the headrest **4** that is performed by inserting the stay **4**B into the cylindrical support **2**S or pulling the stay **4**B therefrom.

Embodiment 2

Subsequently, construction of a cable connection structure of Embodiment 2 is described with reference to FIG. **15**. In the following description, with regard to portions that have substantially the same construction and operation as those of the cable connection structure of Embodiment 1, a description of such portions may be omitted and portions different from such portions will be described.

In this embodiment, engagement projections **42**P and **42**P are formed in the upper end portion of the outer member **42**. The engagement projections **42**P and **42**P are axisymmetrically formed in two positions thereof so as to project radially outwardly. Similar to the engagement projections **41**P and **41**P in Embodiment 1, the engagement projections **42**P and **42**P are constructed to engage the insertion grooves Sd and Sd formed in the support **2**S and the reception grooves Bd and Bd formed in the stay **4**B. That is, in this embodiment, the outer member **42** of the operation cable **40** and the stay **4**B are axially connected to each other.

Unlike the operation cable **40** having a pull-type cable structure in Embodiment 1, the operation cable **40** has a push-type cable structure in which the inner member **41** can push the push rod **50** inserted into the stay **4**B. Therefore, the inner member **41** is made of a rod-shaped member having relatively high rigidity. Further, a pedestal-shaped head portion **41**H is formed in the upper end portion of the inner member **41** such that the push rod **50** can be stably pushed.

In the construction in which the outer member **42** of the first cable **40** and the stay **4**B are axially connected to each other, the outer member **42** and the stay **4**B can be axially connected to each other or disconnected from each other by inserting the stay **4**B into the cylindrical support **2**S or pulling the stay **4**B therefrom.

Two embodiments of the present invention are described hereinbefore. However, the present invention can be carried out in various forms.

For example, as disclosed in Japanese Laid-Open Patent Publication No. 2005-104259, the headrest moving mechanism can be constructed such that when the cables are moved by a desired distance, the support portion of the headrest can directly move in an advancing direction by a distance corresponding to the moving distance of the cables.

Further, the second cable is constructed of the stay. However, the second cable can be constructed of a cable that is additionally disposed.

Further, the insertion grooves formed in the support can be gently curved circumferentially such that the terminal end portions thereof can be directed upwardly. In this case, the engagement projections can be smoothly inserted into the terminal end portions of the insertion grooves by simply inserting the operation cable axially and linearly. Therefore, it is not necessary to rotate the operation cable **40** circumferentially. This may lead to easy operation. However, it must be noted that the temporarily retained operation cable can be easily disengaged from the insertion grooves because the terminal end portions of the insertion grooves are directed upwardly.

Further, the insertion grooves are formed as through grooves that are formed in the circumferential wall of the support. However, the insertion grooves can be formed as bottomed grooves that are formed in an inner surface of the circumferential wall of the support.

Further, the engagement projections formed in the inner member of the operation cable and the insertion grooves and the reception grooves to be engaged with the engagement projections can be a single engagement projection, a single insertion groove and a single reception groove. Conversely, the engagement projections, the insertion grooves and the reception grooves can be three or more engagement projections, three or more insertion grooves and three or more reception grooves. In addition, it is not indispensable that the engagement projections, the insertion grooves and the reception grooves are axisymmetrically formed

Further, in the embodiments, the cable connection structure of the invention is applied to the attaching portion in which the stay of the headrest is attached to the cylindrical support of the seat back by insertion. However, such a connection structure can be applied to various portions in which the cables should be axially connected to each other.

What is claimed is:

1. A cable connection structure for axially connecting a first cable and a second cable to each other,

wherein the first cable and the second cable are axially connected via a cylindrical connection member that is constrained from axially moving,

wherein a connection end portion of the first cable is provided with a radially outwardly projected engagement projection, and a connection end portion of the second cable is provided with an axially extended reception groove configured to axially receive the engagement projection,

wherein the first cable is constructed such that when the connection end portion of the first cable is inserted axially into the cylindrical connection member from a first side, the engagement projection is axially received along an insertion groove that is provided at the cylindrical connection member,

wherein the insertion groove is shaped such that an axial terminal end portion of the insertion groove into which the engagement projection is inserted is bent in a circumferential direction, and when the engagement projection reaches the terminal end position of the insertion groove, the engagement projection is maintained in a condition in which dual-directional axial movement thereof with respect to the connection member is restrained,

wherein a reception groove provided at the connection end portion of the second cable is shaped such that an axial terminal end portion of the reception groove into which the engagement projection is inserted is bent in an opposite circumferential direction opposite to the insertion groove, and when the connection end portion of the second cable is axially inserted into the cylindrical connection member from a second side thereof, the engagement projection of the first cable retained in the cylindrical connection member is axially received along the reception groove of the second cable,

wherein when the engagement projection reaches the terminal end position of the reception groove that is bent in the opposite circumferential direction, the engagement projection is removed from the terminal end position of the insertion groove of the connection member, and as a result, the engagement projection is released from a condition in which axial movement thereof with respect to the connection member is restrained and is placed in a condition in which axial movement thereof with respect to the second cable is restrained, and

wherein in the condition in which the engagement projection reaches the terminal end position of the reception groove of the second cable and axial movement thereof is restrained, the engagement projection is retained in the terminal end portion of the reception groove by an axially extended portion of the insertion groove that is formed in the connection member, and as a result, the cables are axially integrally connected so as to axially move while integrated with each other.

2. The cable connection structure as defined in claim **1**,

wherein when the second cable is pulled from the cylindrical connection member in the condition in which the second cable is inserted into the cylindrical connection member and in which the cables are axially integrally connected, the engagement projection of the first cable retained in the terminal end position of the reception groove of the second cable is guided by the terminal end portion of the insertion groove of the connection member that is bent in the circumferential direction, so as to be removed from the terminal end position of the reception groove of the second cable, and as a result, the axial connection condition of the cables are canceled.

3. The cable connection structure as defined in claim **1**,

wherein at least one of the insertion groove provided at the connection member and the reception groove provided at the second cable is shaped such that the terminal end portion thereof is circumferentially smoothly curved.

4. The cable connection structure as defined in claim **1**,

wherein a plurality of engagement projections are provided at the first cable so as to be axisymmetrical with each other, and

wherein a plurality of insertion grooves and reception grooves that receive the engagement projections are respectively axisymmetrically provided at the connection member and the second cable so as to correspond to the engagement projections.

5. The cable connection structure as defined in claim **1**,

wherein the first cable is disposed in a seat back of a vehicle seat and the second cable is a tubular stay of a headrest that is attached to an upper portion of the seat back,

wherein a cylindrical support into which the tubular stay is inserted is disposed on the upper portion of the seat back as the connection member,

wherein when the connection end portion of the first cable is inserted into the cylindrical support from below and the engagement projection provided at the connection end portion is retained in the terminal end position of the insertion groove that is provided at the support, the first cable is maintained in a condition in which the first cable is suspended in the cylindrical support, and

wherein when the stay is inserted into the cylindrical support from above, the engagement projection of the first cable is received in the reception groove of the second cable inserted into the tubular stay and reaches the terminal end position of the reception groove, and as a result, the cables are axially connected, so as to be positioned in the axial connection condition in which the cables can axially move while integrated with each other.

* * * * *